SCIENTIFIC AMERICAN

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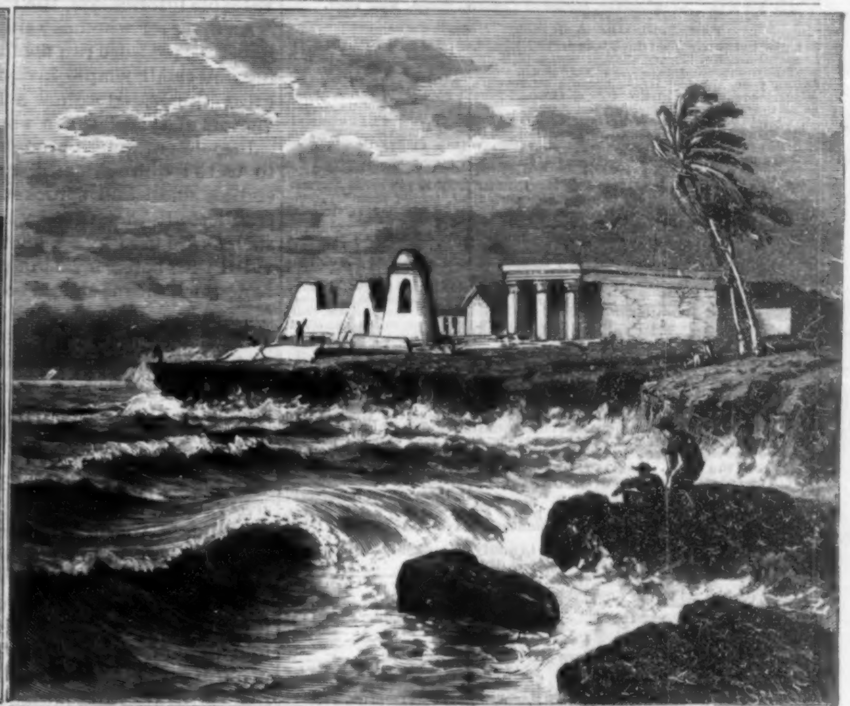

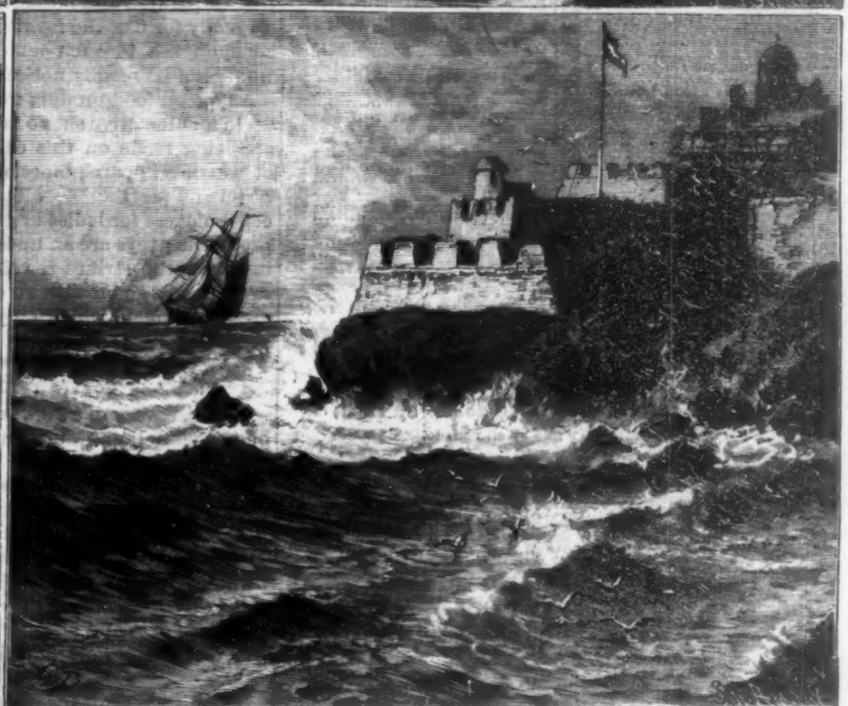

1. Baracoa, where Columbus landed in Cuba. 2. Remains of fort built by Columbus' men, Baracoa. 3. General view of Santo Domingo. 4. Fort at the entrance of Santo Domingo harbor. 5. Cathedral of Santo Domingo, completed in 1540 and claimed to contain remains of Columbus. 6. Castle of Diego, son of Columbus, at Santo Domingo.

COLUMBUS IN THE WEST INDIES.—FROM SKETCHES MADE ON THE SPOT, BY GRANVILLE PERKINS.—[See page 229.]

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NEW YORK, SATURDAY, OCTOBER 8, 1892.

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(Illustrated articles are marked with an asterisk.)

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SCIENTIFIC AMERICAN SUPPLEMENT

No. 875.

For the Week Ending October 8, 1892.

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SUGGESTIONS FOR INVENTORS.

There are at least two classes of inventors which are widely distinguished from each other in two important particulars. Inventors of one class are brimful of ideas, and are able to make choice of a large number of valuable subjects for invention, and seldom or never seek suggestions. Inventors of the other class are ingenious, able to invent when they see a necessity for it, but have not an exhaustless fountain of ideas, and are, therefore, dependent upon what they can obtain from others in the way of suggestions. For the latter class, who frequently inquire as to what inventions are needed, or how to go about it to get this valuable information, the following hints are given.

An inventor who has neither a large fortune nor exhaustless patience can make greater progress by working out small, simple inventions than by attempting great things. Here are a few subjects on which inventors of this class can work:

Bicycles, although brought to great perfection, seem to us to require something neater and better than the endless chain and sprocket wheel for connecting the crank shaft and drive wheel. Rowboats, especially such as are used by sea-going vessels, ought to be provided with better means of propulsion than the ancient oar. Such means should be something like the modern screw propeller, substituting man power for steam power. The important part of this invention would lie in the motor to be operated by the men. It should be very simple and so constructed that, although unused and exposed to the weather, it would still be ready for instant use at any time. The same device would apply to pleasure boats.

In these days apartment houses and flats are extensively used for dwelling places, and where room is economized to such an extent, furniture should be made to conform to the conditions: that is, to facilitate the delivery of furniture to such places and for convenience in moving, house cleaning, storage, etc., the furniture should all be made so as to knock down and fold up flat or nearly so. The parts of each piece of furniture should be connected so that they will not become separated and mismatched or lost, and when set up ready for use, the furniture should resemble that in common use to such an extent that the difference would not be readily noticeable.

Any good food product made in a new form and put up in an attractive shape takes well, and large fortunes are being made on this class of inventions. Articles of wearing apparel, especially those used by ladies, if novel and pleasing, go without much urging. Pocket conveniences for ladies or gentlemen are apt to prove profitable; toys are an unending source of profit to the inventor who strikes a vein of "taking" things, and so we might go on with an endless variety of subjects, great and small, which only await the wideawake inventor.

JUPITER'S NEW MOON.

The discovery of a new secondary planet is an event of no small importance in the world of astronomy. The fifth moon of Jupiter came into the ken of the great Lick telescope a few days ago quite as unexpectedly as the two satellites of Mars swam into the field of the Washington telescope in 1877. Neither E. E. Barnard nor Asaph Hall was looking for new or hitherto unseen worlds when they achieved immortality by a keenness of vision which enabled their practiced eyes and trained intellects to perceive what had escaped a host of other observers in the same field.

The discovery of the new Jovian satellite disturbs that nice geometrical progression which aided students to memorize the number of moons belonging to the solar system. Beginning with the earth and proceeding outwardly the account stood as follows: The earth one, Mars two, Jupiter four, Saturn eight, Uranus four, and Neptune one, total twenty. We might reasonably hope to find another satellite revolving around Neptune, thus perfecting the geometrical sequence, but the harmony of arrangement is utterly destroyed by the intrusion of Barnard's fifth satellite among Jupiter's moons.

Questions at once arise in the mind of the physicist, What is the meaning of this little lunar world? What relation does it sustain to the Jovian system? What light does it throw upon the process of world making? Are Jupiter and the other giant planets still engaged in throwing off new masses from their bulging equators?

The rapid diurnal rotation of both Jupiter and Saturn, giving objects on their surface an enormous centrifugal motion, lends color to the latter conjecture, and we notice that this theory has been broached by a writer in the Chicago *Post*. But is it tenable? Jupiter has long since cooled down from a gaseous to at least a semi-solid condition, and is about one-third heavier than water. It is true that the velocity of its diurnal motion has caused its equator to protrude so that the planet presents an oblate appearance in a telescope of moderate power, and measurements show that its equatorial diameter is 5,300 miles greater than its polar; but it is a simple problem to compute the centrifugal force of 26,000 miles per hour at the Jovian equator and compare it with the centripetal force of the planet's prodigious attracting mass. The latter greatly preponderates, and if calculations are not at fault, the giant planet has been holding itself firmly together for countless ages, and the active little world discovered by Barnard has been pursuing its rapid journey for a corresponding period of astronomical eons.

We can better appreciate the significance, or perhaps we should say the insignificance, of this little moon by comparing it with the other Jovian satellites and our own moon. With the exception of the minute orbs moving around Mars, it is he smallest known satellite of the solar system. But there are many asteroids which rival it in diminutiveness; these, however, are only half as far away as the Jovian system, and are not dimmed by proximity to his overpowering luster. Following is a table of Jupiter's moons—the outer four being copied from Young's "General Astronomy."

	Distance.	Diameter.	Period.
Barnard's	112,000	100	12h.
Io	261,000	2,500	1d. 18h.
Europa	415,000	2,100	3d. 13h.
Ganymede	664,000	3,550	7d. 4h.
Calypso	1,167,000	2,900	16d. 17h.

The second column gives the distance in miles from the center of the planet. As Jupiter has a diameter of 86,000 miles, Barnard's moon is only 70,000 miles from its surface, or less than one-third the distance of our moon from the earth. As our moon is 240,000 miles distant, has a diameter of 2,160 miles, and makes a siderial revolution in 27 days and 8 hours, it will be seen that it approximates the satellite Io in distance from its primary, and Europa in size. But note the great disparity in periods. While Io, a little further away than the moon, darts around Jupiter in 42 hours, our plodding satellite consumes 656 hours, or nearly sixteen times Io's period to accomplish a shorter journey.

This is striking evidence of the overwhelming mass of Jupiter as compared with its retinue of satellites. While it would require but 50 of our moons to equal the bulk of the earth, and 81 to equal its mass, it would require 316 earths to equal the mass and 1,300 to equal the bulk of Jupiter. These Jovian moons, then, are forced to move with high centrifugal velocity to overcome the attractive power of the mighty central mass.

Comparing these moons with some of the other planets, we find that Calypso has nearly the same diameter as Mercury, and Ganymede would equal the bulk of Mars if its diameter were 650 miles greater. Titan, the sixth moon of Saturn, is the only other satellite which equals Ganymede in size.

Are these Jovian and Saturnian worlds, with nearly half the earth's diameter, inhabited? Probably not. They may have low forms of animal and vegetable life, but the conditions do not seem favorable for the development of intelligent beings. If they have oceans and atmospheres, their vast primaries would produce such enormous tides that scarcely any portion of the habitable land would escape overflow. Of course we cannot even imagine the Barnard satellite to be the abode of life. A world only 100 miles or so in diameter parts with its heat very rapidly, and we may fairly assume that its surface is as cold as interstellar space.

But suppose a human being were permitted to step upon the surface of Io, what a magnificent celestial panorama would be unrolled to his gaze! Mighty Jupiter, with an apparent diameter 43 times that of our moon, would cover an area of the starry heavens 20 degrees in diameter. He would hide the entire constellation of Orion at one time. Unlike the unchanging face of our dead moon, which reflects only 17 per cent of the sun's rays, his surface is covered with great masses of brilliant vapor swirling and rolling and heaving in billows of tremendous agitation and reflecting 62 per cent of the sun's rays. And in addition, four balls, of lesser light, varying in size, and exhibiting all the phases from slender crescents to full-orbed globes, would be seen gliding across the heavens in a maze of intricate and rapid motions.

DREDGING THE HONOLULU HARBOR BAR.

A matter of interest to engineers and of great value to commerce is the accomplishment of the work of cutting a channel 200 feet wide and 30 feet deep through the bar at the entrance of the harbor of Honolulu, Hawaiian Islands.

The harbor is a deep, narrow channel, extending from the shore line out to the deep waters of the open sea—a distance of about 7,000 feet. It is flanked on both sides by extensive mud and sand flats, which are bounded on the seaward side by a line of coral reefs of irregular depth, upon which the surf is continually breaking. The width of the channel directly in front of the city is from 800 to 900 feet, gradually contracting to a width of about 450 feet at its mouth. The bar is situated near the outer end of the channel, is about 1,100 feet in length above the plane of 30 feet depth, and has on its apex a minimum depth of 21 feet at low tide. Inside of the bar, the depth of the harbor varies from 18 to 39 feet. The average rise of ordinary tides

is one and seven-tenths feet; of spring tides, two feet; and of neap tides, one and two-tenths feet.

In May, 1890, Mr. Lorrin A. Thurston, then the very able and progressive Minister of the Interior of the Hawaiian kingdom, commissioned Mr. G. F. Allardt, an eminent civil engineer from California, to investigate the subject of deepening the bar. The engineer was to report: "First, the proper method and plant necessary to remove the bar; second, the estimated cost of the same; and third, the proper method of thereafter keeping the channel open."

Mr. Thurston having shortly afterward resigned, Mr. C. N. Spencer, the present Minister of the Interior, took up the work with great interest and has carried it to a successful conclusion. After a very careful examination, Mr. Allardt reported that the material in the bar, to a depth of 30 feet at low tide—ascertained by numerous borings made with an ordinary sand pump worked by hand—consisted of loose coral sand, with a few scattering pieces of coral. To secure a clear and indisputable depth of 30 feet, he estimated that the amount to be excavated would ultimately reach 60,000 cubic yards.

The dredging operations of the United States government in San Francisco Bay and Oakland Harbor, where the material is similar and where the hydraulic method of pumping it up and transporting it by water carriage through sheet iron pipes to the place of deposit has been very successful, furnished a basis for estimating the cost of similar work at Honolulu.

The Hawaiian government was desirous of reclaiming a tract of about 28 acres of land in the eastern part of the harbor, at an average distance of 2,500 feet from the bar. Taking into account the building of a levee around this tract, the greater cost of labor and coal, the increased expense of shipping the machinery of the dredger in detached parts from San Francisco, Mr. Allardt estimated the cost of deepening the channel at $98,000. Of this sum $65,000 was allowed for a dredging machine of the Von Schmidt pattern, $6,000 for cost of pipe, and the remaining $27,000 for dredging.

He further suggested that to get the full benefit of a deeper channel across the bar an equal depth should be secured in the harbor itself. Accordingly, to obtain a uniform depth of 30 feet at low tide over all that portion of the harbor comprised within the line of 18 feet depth, it would be necessary to excavate about 640,000 cubic yards of material, which would be sufficient to reclaim and bring up to a suitable grade about 80 acres of land now useless for business purposes.

Frequent soundings made on the bar during the past forty years show no material change in the depth of water, proving conclusively that during that period of time no appreciable movement of material has taken place either outside or inside of the bar, or on the bar itself.

The Honolulu bar, like others in tidal waters, was probably formed by the action of opposing forces from within and without. In course of time these reached an equilibrium and resulted in the present permanent condition of the bar. It is probable that as this condition of equilibrium is disturbed by the artificial deepening of the bar the same forces will tend to fill it again to the normal depth. This will be very gradual, however. The concentrated ebb current will assist in scouring the channel and aid slightly to keep it open.

In accordance with the advice of Mr. Allardt, the Hawaiian government gave the contract for building a Von Schmidt dredger to the Risdon Iron Works and San Francisco Bridge Company, jointly, for $65,000. This was commenced in July, 1891, and finished May 30, 1892. It consists of a flat-bottomed rectangular scow 100 feet long, 40 feet wide, and 9 feet deep, carrying a centrifugal pump driven by a pair of compound condensing engines of 350 horse power. There are also a pair of engines of 75 horse power for the cutter gear, and another pair of 75 horse power for the winches. All the engines and pumps exhaust into a surface condenser. Steam is supplied by a pair of fire box boilers 6 feet in diameter and 22 feet long. The pump is guaranteed to raise 10,000 cubic yards of coral sand or 60,000 yards of mud per month, but its actual capacity is probably three times that amount.

The contract for dredging was taken, by the same companies jointly which built the dredger, at $49,000, a sum considerably above the estimate, after a very careful personal examination of the bar by Mr. J. McMullan, the president of the San Francisco Bridge Company.

The dredger commenced work on the 7th of April, but it was discovered immediately that some changes were necessary both in the machine and the methods of operating. The very considerable swell on the bar precluded the use of the rigid spuds or piles made for holding and regulating the progress of the dredger, and also made it impossible to use the rigid suction pipe built into a heavy hinged framework, extending from the front end of the scow. The use of the piles was discontinued after several had been broken, and a loose suction pipe was hung in chains under the forward projecting frame, with a play of 14 feet for the rise and fall due to the swell. The Risdon Iron Works have since taken out a patent to cover this feature. The scow was moored to several anchors on both sides of the channel. The fact, however, that the prevailing fresh trade wind blew very nearly in the direction of the axis of the channel, permitting the dredger to tail on to an anchor astern, was the principal element in favor of the accomplishment of the work. Had the wind been variable, the difficulties would have been almost, if not quite, insuperable.

In this operation the Bowers patent cutter, inclosing the outer end of the suction pipe, has been useless. Fortunately, it has not been needed, as the bank of sand has been disintegrated by the indraught of the pump. From the time the dredger got fairly started on the 12th of June until the 27th of August the work progressed without interruption, night and day, except during several interruptions, when slight and usual repairs to the machinery were needed. On the last named date a channel of 100 feet wide, to a depth of 28 feet at low water, was entirely done, and there was but three days' work to finish a small portion on the outer eastern side to complete the channel to a width of 200 feet. One week's additional work in going over the entire area of the cut to reduce several 28 feet deep lumps will leave a clear channel of 30 feet deep at low water.

The Hawaiian government intends to go ahead at once to clear out the harbor to a depth of 30 feet to the present 18 foot line. As it is completely land-locked and the bottom is of soft mud, there will be no hindrance to the speedy conclusion of this excavation. Any possible filling in the harbor hereafter, or of the bar, can always be removed at once by the efficient dredger now in their possession.

It is certain, therefore, that before the 15th of September, the Hawaiians will possess one of the best protected and most accessible harbors for deep draught vessels in the world. This is of especial interest in view of the discussions relative to the acquisition of a ready-made coaling station in the vicinity of Honolulu.

The Tacoma and Steilacoom Electric Railway.

Any one who has never ridden through the mighty forests of Washington can poorly form any commensurate idea of their vastness and density. Giant firs and cedars, three and four feet in diameter at the base, rise majestically to a height of three hundred feet, and so numerous are they it seems as if an additional tree could scarce find standing room. The warm climate and exhaustless moisture furnish unequaled growing weather the year round. As one looks into these woods, vision is obstructed at a short distance by what seems a solid wall of trees.

But it was through no less impregnable a forest that the Tacoma and Steilacoom Railway Company chose its course, and taking the policy of the steam roads of the far West, followed a river canyon as far as possible. At the time of its construction it was the longest continuous electric line in the country; now it divides that honor with several others.

It was in August, 1890, that construction was commenced from the city of Tacoma to the town of Steilacoom, Washington, on the line that in many respects takes the lead among electric roads, especially in the character of country traversed. Its completion demonstrated that such lines are a great factor in the development of a new country, and are a success both as to operating details and as a business proposition. The Tacoma and Steilacoom Railway Co. awarded the contract for the construction of their road to the Northwest Thomson-Houston Electric Company, of St. Paul, Minn., including the grading and laying of the track. The work was begun in August, 1890, and was completed and ready for operation on April 1, 1891. The road commences at corner of K and Eleventh Streets, in the city of Tacoma, and runs west and south to the town of Steilacoom, a distance of thirteen miles. The country between the two towns is very rough and covered with a dense growth of giant fir and cedar trees, which had to be cut down for the right of way and the immense stumps blown out with giant powder. Hills were cut through in places to a depth of seventeen feet, and corresponding gullies filled up, and creeks crossed on long trestles, making a very expensive roadbed. The track is laid with forty-pound tee rail on fir ties, hewn from timber cut off right of way. The poles are all of cedar, and were cut along the line. Ten miles of the road have bracket poles, and the other three in corporate limits have cross suspension. Leaving K Street, the car runs west through West Tacoma, a distance of two miles, to the power house. This section of the city two years ago was a forest. To-day it is the home of 3,000 people, and has ten miles of graded streets, a fine school house, stores, handsome houses, and water and electric lights. The power station and car house is a frame building on brick foundation, 120 by 125 feet, including engine and dynamo house, 70 by 70 feet, two stories in height, the upper story used by the offices and by the employes; car barn 55 by 120 feet, with capacity for fifteen 30 foot cars, and boiler and fuel room 50 by 70 feet, the building being wired for fifty incandescent lights. The steam plant consists of one 250 horse power tandem compound non-condensing McIntosh & Seymour engine, and two 125 horse power return tubular Erie steel boilers, with feed water heater, purifier, injector, deep well, and boiler pump.

The electric plant consists of three 80 horse power Thomson-Houston railway generators. The switch board is made of black oak, the instruments being connected with polished copper rods on the front of board, presenting a very handsome appearance. The rolling stock consists of seven double truck motor cars, 30 feet over all, each equipped with two 25 horse power T.-H. railway motors, and two open cars, each equipped with two 15 horse power waterproof motors. The dynamo room at the power house is finished in oil and has a traveling crane of ten tons capacity, built in Tacoma, after designs by Mr. Livermore, engineer in charge of construction. Leaving the power house, the road runs one mile west through an immense cut, 17 feet deep and 1,200 feet long, descending an 8 per cent grade 1,500 feet long, then turns to the south and west and runs several miles through a dense forest of immense fir trees until, after descending a horseshoe curve on a 6 per cent grade for half a mile, the country opens out to a beautiful prairie dotted with dwarf firs and scrub oaks and covered with flowers and vines. Crossing this prairie for a mile, the road suddenly plunges down into an immense canyon, following the contour of the side on a five per cent grade for over a mile, making a most beautiful and romantic ride. At many points it was necessary to blast a roadway out of the mountain side, and as the car glides along its narrow path, winding around the jutting points of rock, the tree-covered mountains above afford a striking contrast to the dashing water a hundred feet below. The canyon ride is one never to be forgotten. Reaching the bottom of the canyon, the river is crossed on a trestle 300 feet long, and the road winds along its banks for a mile and a half, and at last abruptly turning a point, opens out onto Silver Beach and follows the shore of Puget Sound to the quaint old town of Steilacoom.

The view here is magnificent. The car runs along only 20 feet above high water, giving the passengers a lovely view of the sound, with its deep blue waters shining like a mirror, its lovely islands, and in the background the grand, rugged summits of the Olympic mountains, always snow-covered and beautiful. Then up a 7 per cent grade into Steilacoom, the oldest town on Puget Sound, the early rendezvous of the Hudson Bay Company's employes, and a place of refuge for the adventurous white settlers during Indian wars. The road runs through the center of the town on a fine graded avenue and reaches the water on Union Avenue, where the company has built a handsome depot and restaurant. This road leads all others in distance to which power is transmitted from station, the Steilacoom end being eleven miles from the power house. This is successfully accomplished by a complete system of feeders and by using the waters of the sound and of a creek for a ground return. The construction and equipment of this road was done under the sole supervision of S. B. Livermore, who has been an engineer of the railway department of the Thomson-Houston Electric Company since March, 1889.—*Street Railway Review.*

Cements.

The following formulas have been devised by Eugene Dieterich:

Cement of Pompeii, or Universal Cement.

Dissolve 8 ounces of sugar in 24 ounces of water in a glass flask on a water bath, and to the thin sirup add 2 ounces of slaked lime, keep the mixture at a temperature of about 70-75° C. for three days, shaking frequently, then cool, and decant the clear liquor. Dilute 6⅙ ounces of this liquor with as much water, and in the mixture steep 16 ounces of fine gelatine for three hours after heating to effect solution. Finally add to the mixture 1⅙ ounces of glacial acetic acid and 15 grains of pure carbolic acid.

Diamond Cement.

	Oz.
Fine gelatine	3
Water	4
Glacial acetic acid	1

Let these stand together for several hours, then heat to effect solution, and add 10 grains of carbolic acid to preserve the cement.

Liquid Glue (Sydetikon).

For this use 4 parts of the above mentioned saccharated solution of lime and dissolve 6 parts of glue or gelatine in it as there directed. Then neutralize the lime with a third part of oxalic acid, and add carbolic acid, in the above mentioned proportion as a preservative.

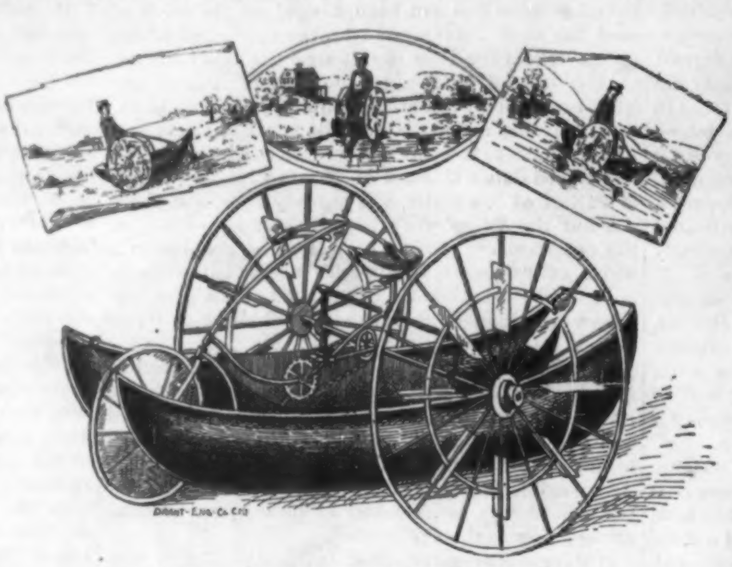
Cement for Porcelain.

Twenty parts of white lead and 12 parts of pipeclay, carefully dried, are incorporated with 10 parts of boiled linseed oil, heated on a water bath. The cemented articles are dried slowly in a warm place.—*Pharm. Centralhalle and Amer. Jour. Phar.*

COMBINED CYCLING AND BOATING MACHINE.

Land and water have been traveled over by vehicles or devices wherein each was adapted to its special sphere. Seldom have land and water been laid under contribution by a single mechanical device. It remained for the genius of a citizen of Chicago to devise a machine for both use and pleasure, which should enable his fellows to traverse with great speed either land or water, proceeding readily from one on to the other. This Mr. Thore J. Olsen has done by means of a combined tricycle and boat, or boats, so connected that they operate together most perfectly on either element, although it takes but a moment to separate the boat from the tricyle.

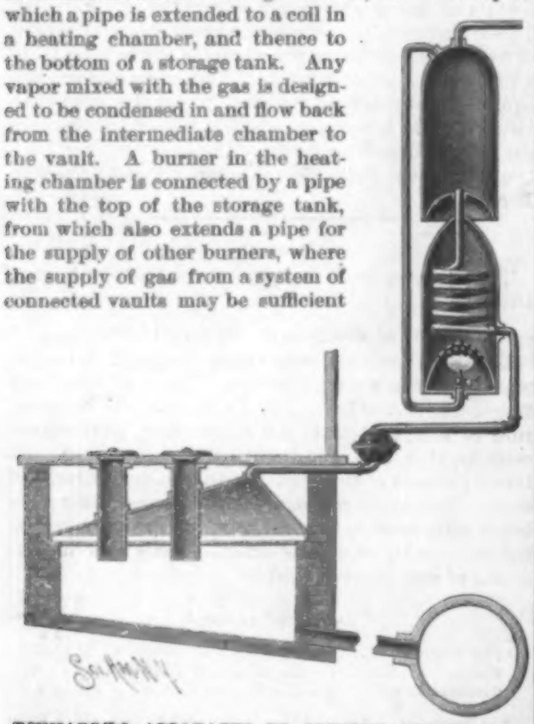
In the accompanying sketch the machine is shown ready for use. It consists of twin boats rigidly connected and a tricycle connected to said boats so ingeniously arranged that the machine is propelled and steered by the same mechanism. This machine has the most perfect stability in either element, is light, sightly, and attractive, producing the liveliest interest when exhibited on account of its originality. In this device the traveler may carry his necessary baggage, tools, and hunting and fishing tackle, yet the whole device without load weighs but from 50 to 75 pounds, and while it is arranged to carry but one person on land, its buoyancy is such that it will carry two and sustain three or more persons on the water. Thus the traveler, the pleasure seeker and the military man will not be hindered from reaching each his destination on account of floods, washed-away bridges or no bridges or pontoons. This device has been patented and its capacity and popularity demonstrated during a part of the past season. Further particulars with reference to this improvement may be obtained of Mr. T. J. Olsen, 427 W. Madison Street, Chicago.



OLSEN'S CYCLING AND BOATING MACHINE.

AN APPARATUS TO CONSUME SEWER GAS.

An improved means of conducting away the gas from privy vaults, with the design of also making it available for illuminating purposes, is shown in the accompanying illustration, and forms the subject of a patent issued to Mr. Jacob Eckhardt, of No. 3913 Vest Avenue, St. Louis, Mo. The top of the vault is covered with a tight-fitting, somewhat triangular-shaped hood, through which the receiving tubes of the vault descend, by means of close joints, so that the volatile gas will not escape from the hood into the tubes. A discharge pipe leads from the bottom of the vault to the sewer, and from the apex of the hood a pipe leads to an intermediate receiving chamber, from the top of which a pipe is extended to a coil in a heating chamber, and thence to the bottom of a storage tank. Any vapor mixed with the gas is designed to be condensed in and flow back from the intermediate chamber to the vault. A burner in the heating chamber is connected by a pipe with the top of the storage tank, from which also extends a pipe for the supply of other burners, where the supply of gas from a system of connected vaults may be sufficient



ECKHARDT'S APPARATUS TO CONSUME SEWER GAS.

to utilize it for illuminating purposes. The coil-heating burner may be supplied with gas from other sources, if desired, and, the chamber being closed, an upward current is produced in the coil, while the gas is superheated so that it will not afterward deposit moisture. The apparatus is designed to be of especial value in getting rid of and rendering innoxious the very dangerous sewer gas, even where such gas cannot be turned to use.

MOULDS for casting iron can only be made in sand. Iron or other metallic moulds chill the iron and it does not fill well. The great heat at which iron melts will burn any other material, or will stick so as to break the mould.

Alloys of Iron or Steel and Nickel.

A process of manufacturing nickel steel has been recently patented by Mr. E. F. Wood, of the Homestead Steel Works. The invention concerns, chiefly, the method of introducing the nickel into the presence of the melted iron or steel and securing its admixture therewith, and it consists in effecting the reduction of oxide of nickel in the presence of the fused iron or steel, either before or after the decarburization of the pig metal, by mixing the oxide of nickel with carbon and exhibiting the mixture to the metal fused or in the process of fusion, so that the nickel ore may be reduced. The nickel oxide used may be any of the natural ores, or what is known as "artificial" nickel ore, which is preferable on account of the leanness of the natural ores, and generally analyzes about as follows: Iron, 23·870; nickel, 48·230; phosphorus, 0·007; silica, 1·900; sulphur, 0·264; copper, trace; oxygen and earthy matter, 25·729 per cent.

The process of manufacture of this nickel steel differs only from the ordinary open hearth or Bessemer process in the manner of introducing the nickel, which is thus accomplished. The nickel addition is prepared by grinding or otherwise pulverizing the nickel oxide and then mixing it with powdered charcoal or coke in the proportions of about one part, by weight, of carbon with three parts, by weight, of pulverized nickel ore. If a lean natural ore is used, a smaller percentage of carbonaceous matter will be required, and if the proportion of nickel in the material used is greater or less than before mentioned, the amount of carbonaceous matter should be correspondingly increased or diminished, the object of the carbon being to effect the reduction of the oxide of nickel, the exact proportions of carbon added being easily determined in practice. The nickel and carbon being intimately mixed, are formed into a plastic mass, with a sufficient quantity of some binding material, such as tar or silicate of soda, and this plastic material is formed into small masses, preferably bricks, which are compressed into a solid condition. The purpose of this pressure is to compact the materials, so that they can the more readily be kept immersed in the melted metal. It is preferable to previously dry the ore, so as to render the bricks more compact and to prevent the presence of water. The amount of oxide of nickel contained in these bricks can be readily determined by a previous analysis of the ore (natural or artificial) of which they are composed, and on the quantity of such bricks used with a given charge of metal will depend, of course, the percentage of nickel contained in the resulting product, which may vary in any desired degree, according to the character of the nickel iron or nickel steel to be manufactured, it being understood that an allowance should be made for the loss of about 10 per cent. of metallic nickel, which passes into the slag and is lost.

The amount of this loss varies, however, somewhat with the different processes of iron or steel manufacture.

The application of the process to the open hearth furnace is thus described: The open hearth furnace being suitably heated, a proper proportion of nickel-addition bricks is placed on the hearth, mixed with the charge of pig metal, which is so placed as to prevent the bricks rising to the surface of the metal as it melts, after which the open hearth process is carried on in the usual way, the decarburization of the pig metal and its subsequent recarburization, together with the addition of spiegeleisen or ferro-manganese, being conducted in the usual manner. The effect of introducing the nickel addition in the manner described is that the oxide of nickel is reduced in the presence of the melting or melted pig metal, and the metallic nickel thus produced becomes intimately mixed with the iron, while the earthy and foreign matter of the nickel ore is melted and unites with the slag. The process applies also to the use of the nickel addition in the basic process of decarburizing pig metal without any other change than the addition of the nickel bricks, and it is found preferable in the basic process to add the bricks after the addition of the limestone and before charging the pig iron, so as to bring the nickel bricks into more intimate contact with the melting iron or steel.

When used in connection with the Bessemer process it is preferable to introduce the nickel additions into the iron ladle as the molten pig metal is being charged into the converter, if the iron were hot enough at that stage of the process; but as this is usually not the case, it is better to introduce the nickel brick into the Bessemer converter before the molten metal is charged, no other change in the conduct of the Bessemer process being required; or the nickel bricks may be added to the Bessemer metal in the steel ladle at the end of the process, the steel being blown hot enough to cause the complete fusion of the bricks, in which case the nickel ore will be at once converted into metallic nickel and mingled with the liquid steel.

Water Power Electricity.

The description by the *Electrical World* of the most powerful plant in this country for the transmission of electric power is interesting. The plant is now in course of construction for the San Antonio Electric Light and Power Company in the San Antonio canyon, in Southern California. There is a minimum flow of 1,300' of water per minute, affording a head of about 400'. The water is brought to the power station through 1,900' of 30" and 600' of 24" double riveted sheet iron pipe, which involves a loss of head by friction of 12', leaving 390' effective head or running pressure. The power station is provided with four double nozzled Pelton wheels 34" in diameter coupled direct to the armature shafts of as many Westinghouse alternating current generators of 200 horse power each.

The current generated will be carried on two No. 7 bare copper wires down the canyon to a point where they diverge, one running to Pomona, 15 miles, and the other to San Bernardino, 28 miles, covering by the return circuit in the latter case a distance of 56 miles. By means of transformers, the potentials will be raised at the generating station to 10,000 volts, and the current carried at this pressure to sub-stations just outside the cities named, where, by means of step-down transformers, it will be reduced to about 1,000 volts and then distributed for both light and power purposes.

A NOVEL DESIGN FOR A BADGE.

The badge design shown in the illustration, having an interior representation of a globe surrounded by a series of women's heads, has been patented by Mr. W. B. Munger, of 21 North Fifteenth Street, Harrisburg, Pa. The ornamentation forms a rebus, enigmatically expressing "World's Fair," while an eagle surmounts the body of the badge.

MUNGER'S "WORLD'S FAIR" BADGE.

Luminosity of Vacuum Tubes.

In the course of a discussion before the British Association on a paper by Prof. Schuster on "Primary and Secondary Cells," Mr. Crookes stated that if a long vacuum tube containing oxygen exhausted to a point giving the greatest luminosity is held somewhere near a plate connected with one of the terminals of a high tension coil it becomes very luminous. If the tube has been lighted and put in a cool, dark place, and thereafter held near a coil, it remains dark, and no amount of placing it near the coil will make it luminous. If the tube is rubbed, it suddenly flashes into luminosity, and remains so; but if laid down in a dark room for an hour, it becomes non-sensitive again. It seemed to him that the gas inside the tube requires to be put in a state of disassociation. Prof. H. Von Helmholtz, who was one of the lions of the meeting, said he believed that in these vacuum tubes, if there is a little stratum of gas adhering to the surface there are always molecules, which can be separated into positive and negative. There is really a measurable stratum of air adhering to the interior of the glass tubes. If a rarefied vacuum is made, the greater part of that air goes away; but there are always traces of gas left, even in the vacuum of a glass tube which is completely melted.

Wonders of Natural Gas.

The Pittsburg *Dispatch* says: Pittsburg is again a great gas city. Never since the early days of natural gas has this precious fuel been so abundant. The prediction by the *Dispatch* at the discovery of the Pinhook field that there was an abundance of gas for ten years has more than been fulfilled. With the additional discovery of the new field at Elizabeth, gas experts claim the outlook was never brighter. The Philadelphia Company, it is said, is even reaching out for contracts from manufacturers, a thing it has not done for several years.

The men best posted claim there will be more gas in Pittsburg this winter than any time since the palmy days of the Murrysville and Grapeville fields. Though gas is again plentiful, the value of it is thoroughly understood. The prices now paid are the greatest ever known in the history of the business. The famous Snee well has been purchased by the Carnegie Steel Company, Limited. The exact amount paid by the company for this territory is not known, but the price asked by Mr. Snee for his famous well and the lease of 3,500 acres of land was $150,000.

The far-famed Hess well, which was the first discovered in the great Pinhook field, is now practically supplying all the Philadelphia Company's lines. From this one well is drawn the supply for the Brilliant and Herron Hill pumping stations and all the towns along the Allegheny River from Tarentum to Pittsburg. Notwithstanding this tremendous strain, it is claimed 20 per cent of the gas is blowing off at the well. It is like the early days of natural gas, when the pressures were so high it was impossible to hold the full volume in the lines. A remarkable fact in regard to the Pinhook wells is that they have been constantly increasing in pressure since they were first drilled. This is especially true of the Pinhook wells that have been drilled near Milltown. They now gauge double what they did when completed.

The Hess well is now acknowledged the largest gas well and greatest volume well that has ever been struck in any field. This is proved by the fact that it supplies nearly all the Philadelphia Company's lines. The well is actually doing more than any six wells the Philadelphia Company ever had in either the Murrysville or Grapeville fields were ever able to do. At six o'clock on the evening of August 5 there was a line pressure of 987 pounds at the well.

The Philadelphia Company has never had a line pressure equal to this since the days when the Murrysville and Grapeville fields were at their height.

The drill has proved the enormous extent of the Pinhook field, though it has as yet set no limit to its richness. It is from 15 to 20 miles long, and no one yet knows how wide. With this field and the one at Elizabeth at the big Snee well, it shows more gas in sight for Pittsburg from these two new fields than ever before.

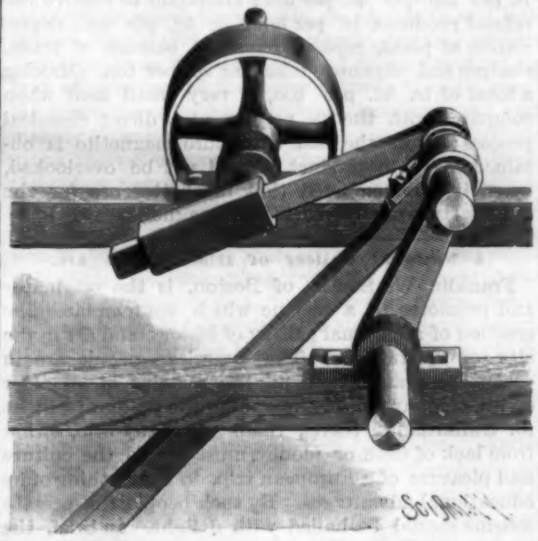
Though the Philadelphia Company was unable to come to terms with Mr. Snee, it purchased a farm in fee simple close to the Carnegie lease. One portion lies so close to the Snee well that the company is now putting up a rig within 125 feet of the great gasser. The supply already assured in Pinhook, with what is expected there, puts not only this company, but the People's Company, in as good condition as ever.

The Fastest Bicycling.

John S. Johnson, of Minneapolis, on September 22, rode a mile on a kite-shaped mile track, at Independence, Mo., in 1 minute 56⅘ seconds. Experienced timers and judges are said to have taken the record, to avoid possibility of error. Two horses hitched to sulkies used to encourage the trotters in their work were selected to make the pace, one going to the half mile, while the other accompanied the wheelman over the latter part of the journey. Johnson set a record-breaking clip from the start, covering the first quarter in 29¼ seconds. The half was reached in 58⅗ seconds, and here the tired horse pulled out. A fresh one came in front of the plucky rider. The three-quarter pole was reached in 1:28¼. It hardly seemed possible that the wheelman could keep up such a clip, but he never faltered, and finished the mile within two feet of the runner's sulky in the wonderful time of 1:56⅘. This performance gives Johnson all the world's records from a quarter of a mile to a mile, and demonstrates his superiority as a short distance rider.

AN IMPROVED MECHANICAL MOVEMENT.

The form of mechanical construction shown in the illustration is more especially designed to facilitate the conversion of reciprocating into rotary motion, at the same time avoiding all dead center positions. The improvement has been patented by Mr. Peter A. Bouchet, of Merced, California. It will be seen that one of the shafts carries at its inner end a socket or sleeve in which slides a bar pivotally connected with the wrist pin of a crank arm attached to the end of another shaft turning in suitable bearings. The centers of the shafts are eccentric to each other, and the wrist pin is connected by a link or pitman with a treadle, the operating of which turns both shafts.

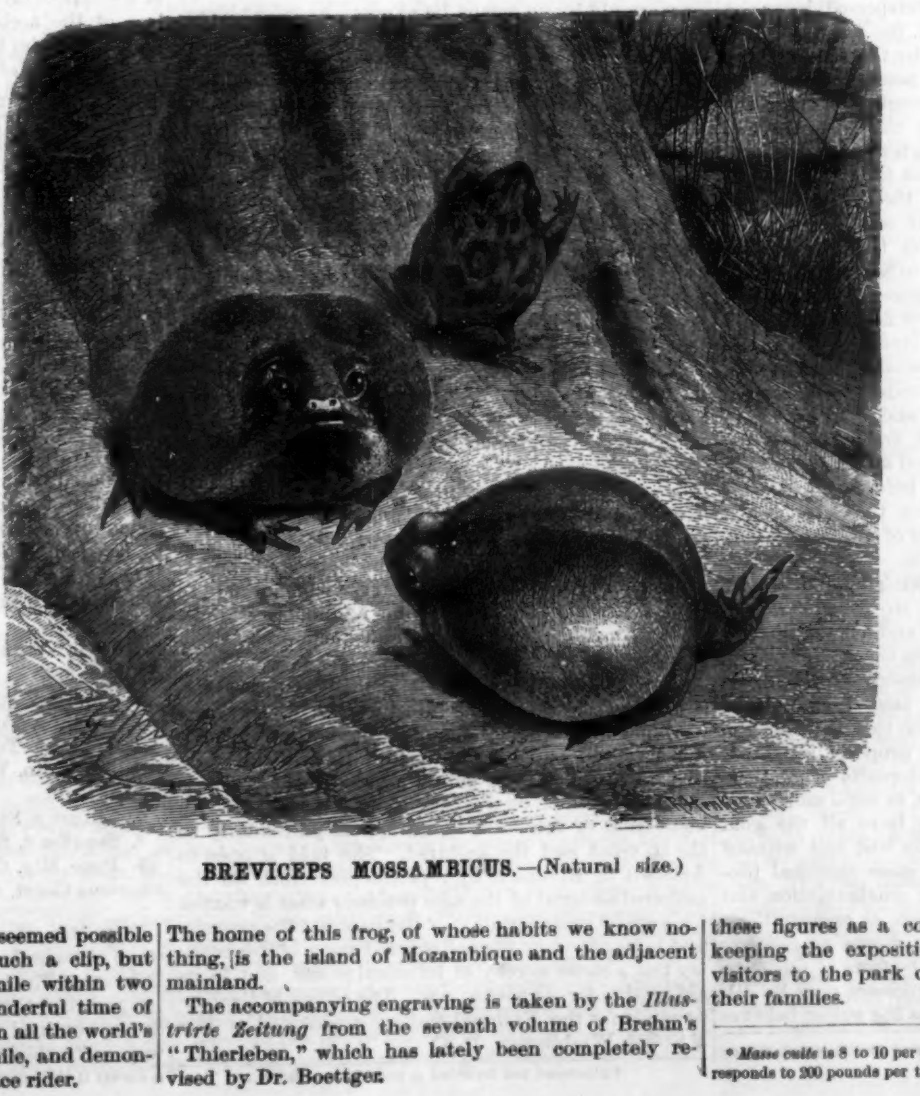


BOUCHET'S MECHANICAL MOVEMENT.

BREVICEPS MOSSAMBICUS.

The picture of these strange creatures reminds one at first glance of rubber balls or stuffed pancakes. Their greatest length is 1½ inches, and their color is a dirty brown on top—sometimes spotted with black—and white underneath, a black band running down from each eye, and the center of the throat being black. On the tarsi of the hind legs there is a hard, sharp-edged callus, an instrument which is probably used by this slow creature, whose only means of locomotion is crawling, to dig up termites, on which it is supposed to live. The smallness of its mouth, the shape and length of its tongue, the lack of teeth, etc., also seem to indicate that this is the nature of its food. The home of this frog, of whose habits we know nothing, is the island of Mozambique and the adjacent mainland.

The accompanying engraving is taken by the *Illustrirte Zeitung* from the seventh volume of Brehm's "Thierleben," which has lately been completely revised by Dr. Boettger.



BREVICEPS MOSSAMBICUS.—(Natural size.)

Brown or White Sugar.

A question that will certainly open up considerable discussion in the future in the manufacture of beet sugar in the United States is, to know if all processes for the manufacture of white crystallized sugar at the factory are to be abandoned in face of the well organized syndicate of the American Sugar Refining Company, which evidently has greater facility for the refining of sugar than would be possible in an ordinary beet-sugar factory.

Even in the present early stages of the industry opinions appear to be very much divided. Some of the factories make a white crystallized sugar testing 99°, while others prefer confining their efforts to raw sugar manufacture and to sell their product to refiners who are willing to contract in advance for all sugar made. From want of space we are not able to enter into the question in detail. It is interesting, however, to call attention to a successful process of manufacturing white crystallized sugar at a low cost, and for which the machinery required costs but a few thousand dollars. A *cleare* is made with the sirup from multiple effect. This is concentrated to 36° B. at a temperature of 104° F. The cleare thus obtained is, in reality, a supersaturated sirup. The green sirup from *masse cuite* is swung out in centrifugals; 10 per cent of the cleare above described is then added, during which time the outer surface of the centrifugal drum is heated with exhaust steam. The sirups running from centrifugals during this operation are subsequently mixed with sirups entering vacuum pan. Special steam injectors complete the sugar washing, and it is said that about 64 pounds white crystals, testing 99°, may be extracted from 100 pounds *masse cuite*.*

It is interesting to compare this process with that of raw sugar extraction, considered on a basis of dollars and cents. For example, we may suppose that beets worked averaged 13 per cent sugar. By American processes there may be extracted per ton of beets 150 pounds brown sugar, testing at least 88°, and worth 2·6 cents per pound, and 50 pounds of a second grade brown, which would have a ready market in New York at 2·3 cents per pound. The total value of these raw sugars would be about $5.05. On the other hand, by the process above described, from one ton of beets there could be extracted 129 pounds of high grade white crystallized sugar, testing 99°. At present market prices this would bring over 4 cents per pound, to which must be added 21 pounds of a lower grade sugar that would have a steady market at 2·3 cents per pound. In this case the total value would not be less than $5.60 per pound. Thus there remains a difference of 55 cents in favor of the process under consideration. For a campaign of 20,000 tons there would be a profit of $11,000. Just within what limits this figure is correct remains to be determined by practical experience. Whatever may be the results obtained, the experiment is worth trying. We shall be pleased to publish any practical data on this point that may be sent to us.

By adopting above method of manufacture there need be no cause for Northern sugar makers to envy Southern sugar manufacturers, who get a bounty upon sugar of 80 per cent test and of quality that may enter into immediate consumption.—ED.—*Sugar Beet.*

Reports from the Great Fair.

The list of British exhibitors in the industrial section, according to advices from Great Britain, already numbers fully 5,000. The best exhibits will be those of pottery and dry goods.

The bonds bear 6 per cent interest, dated November 1, 1892, payable on or before January 1, 1894. They will be issued in denominations of $100, $500, $1,000, and $5,000. An estimate in the prospectus set forth that the probable receipts of the exposition would be $34,500,000 and the disbursements $21,250,000.

The attendance of visitors is increasing. On a recent Sunday 15,000 persons passed through the turnstile. During the week the average daily attendance was 3,000. The officials regard these figures as a convincing argument in favor of keeping the exposition open Sunday. Most of the visitors to the park on Sunday are laboring men and their families.

* *Masse cuite* is 8 to 10 per cent the weight of beets worked, which corresponds to 200 pounds per ton.

Magnetic Particles from Auriferous Ores.*

BY MR. WALTER B. BASSETT.

The demagnetizing of ores containing magnetite or magnetic pyrites has received considerably more attention in America than it has in England, and at the present moment there exist several methods of magnetic extraction in the former country which have attained more or less success in the treatment of granular magnetic ores. The great difficulty which lies in the way of devising a satisfactory process for treating these ores is the fact that, unless the particles are thoroughly disseminated, the magnetic grains, while attaching themselves to the magnets, are apt to inclose certain of the non-magnetic granules with them, and to carry them into the portion of the apparatus destined for the magnetic grains alone. This difficulty is more acutely felt when treating magnetic pyrites or other ores possessed with only a feeble magnetic force, as the stream of magnetic particles must then be directed so close to the magnets that, unless the opposing forces are nicely balanced, there is great probability of error occurring. When the grains vary largely in size it is preferable to screen the ores before subjecting them to a magnetizing process, as it is obvious that extremely fine grains of matter are far less susceptible to the action of any force when acting through a medium, such as air or water, than are grains of a larger size. It therefore follows that an apparatus that is perfectly capable of refining an ore, the grains of which are of fairly uniform size, will fail to do so at one operation when there is a large discrepancy in the size of the particles to be treated.

Experiments have been made on zinc slimes from a mine in the Pyrenees, where some difficulty was experienced, owing to the quantity of magnetite present. In this case a successful treatment was effected by a dry process, but inasmuch as this involved drying the ores before demagnetizing them, an extra expense had hitherto been incurred. But the results of experiments have led the writer to believe that a slightly modified machine, constructed on this principle, will be able to cope with the slimes as they come from the grinding mills, without having to previously dry them. In the case of a sample of magnetic pyrites containing nickeliferous ores the magnetic power possessed by the pyrites was so feeble that a stream of particles descending through water within one-half inch of a powerful magnet was not deflected appreciably, and in order to effect a magnetic separation the particles had to pass within one-eighth inch of the poles of the magnets. For ores of this class it is doubtful whether an economical magnetic separation can be effected, as with such a limited area open to the passage of the grains, as would necessarily be the case, the plant would have to be of very large size to treat ores in quantity. The simplest problem by far is the treatment of the so-called iron sands, found in many countries extending for miles along the seashore. These sands, with the exception of portions where gravel is interspersed, have the grains of fairly uniform size, and, for the most part, with the rough edges rounded off by the action of the water. The grains of these sands, possessing a specific gravity of 5, will readily sink through water, and the separation of the magnetic from the non-magnetic grains can be easily effected through this medium.

A great deal of difficulty has been felt in many auriferous districts in dealing with the ores for gold extraction by processes dependent on the action of specific gravity, owing to the fact that the specific gravity of magnetite is so high as to cause it to remain with the gold after the washing process has been performed. Many sea beaches in New Zealand and California are composed of alternate layers of magnetite and quartz sand, and after a period of heavy gales, when the surf has subjected the sands to a continual washing, the layers of magnetite and gold are found to be almost free from quartz sand, and the line of demarkation between the light colored sand deposited in fine weather and the black sand before mentioned is very plainly seen. It is at this time that the "beach comber," as the alluvial gold miner of the sea beaches is called, reaps his richest harvests. With his beach box, which is a combination of amalgamated copper plates and riffles worked with a stream of water, he washes the sands of his claim over and over again, and rarely finds that gold is absent from them.

It is from these sands, when properly treated by a demagnetizing process, that the largest amount of gold may be obtained. Working on this principle the magnetite once and for all will be properly separated from the gold, and unless further deposits of gold are washed up from beyond low water, as some miners believe, the whole of the sands may have all the gold contained therein extracted at a low cost and without the possibility of error. In many cases chemical processes can be substituted for the amalgamation and washing processes, but the problem as regards these may be summed up in a very few words as follows: Will the amount of gold obtained be from ¼ ounce to 1 ounce per ton? If not, these processes may be dismissed without further thought, as the writer believes that the cost of the most modern of the cyanide or chlorination systems, with the most favorable adjuncts, cannot be brought below £1 per ton of ore treated, while many others cost a good deal more.

With electro-magnets the cost of treatment when water power is procurable is estimated at 1s. 6d. per ton, made up as follows: Attendant at turbines and dynamo, 1s. per hour, or 3d. per ton; attendant to feed sand to machine by means of a centrifugal pump, 1s. per hour, or 3d. per ton; attendant to remove the refined products, 1s. per hour, or 3d. per ton; depreciation of plant, repairs, renewals, balance of trade, charges and expenses, taken at 9d. per ton. Making a total of 1s. 6d. per ton, a very small item when compared with the 20s. per ton of a direct chemical process; while the fact that pure magnetite is obtained as a by-product should not be overlooked, when it is remembered that no better ore for the manufacture of steel exists than magnetite.

* Abstract of paper read before the Federated Institution of Mining Engineers, September 7, 1892.

A National Gallery of History and Art.

Franklin W. Smith, of Boston, is the originator and promoter of a scheme which contemplates the erection of a national gallery of history and art in the city of Washington. The American people are in oceanic separation from all the remains of an older civilization, and notwithstanding the present facilities for transatlantic travel, there are many who, either from lack of time or money, must forego the culture and pleasure of a European trip, to say nothing of its educational advantages. By such people, the present scheme should be hailed with delight. In brief, the plan is as follows: To erect in Washington, D. C., in some commanding position, a range of galleries one story in height, terraced upon a hillside. The design prepared by Mr. James Renwick and Mr. Smith calls for eight historical galleries, viz., Egyptian, Assyrian, Greek, Roman, Byzantine, Mediæval, Saracenic, and East Indian, these to be ranged below American galleries for illustration of the history and portraiture of the United States, the group to be ultimately surmounted by a memorial parthenonic temple, an American Walhalla, such as stands to-day in grandeur and beauty upon a hill top overlooking the Danube, a proud manifestation of the artistic inspiration and patriotism of the Bavarian people. It is proposed that the galleries shall inclose small parks in which constructions of the above named types can be erected in full size. The galleries are to be filled with mural paintings illustrating the history of the people to which it is devoted. That Mr. Smith is not a visionary enthusiast is shown by the "Pompeia," the matchless restoration of the house of Pansa at Pompeii designed and built by Mr. Smith at Saratoga Springs, N. Y.,* and in the Villa Zorayda, his winter home opposite the Ponce de Leon, in St. Augustine, Florida, a magnificent replica of parts of the Alhambra.

The expense of a construction of this kind, though large, would by no means be as great as might be expected from the ground plan. A conservative estimate places the cost of the galleries at $5,000,000, or $10,000,000 for the entire buildings. The following extract from the prospectus will give an idea of the proposed plan of construction:

"The simple form and uniform construction of the buildings are advantageous for economy in construction. The material proposed is economical to an extraordinary degree, compared with the imposing governmental and other constructions of the present time. It is a sand and Portland cement concrete, such as was used in the construction of the hotel Casa Monica, in St. Augustine (there with a small fraction of 'coquina' or shell); and especially as used in the Pompeia at Saratoga Springs, on the exterior wall, for the pavement and in the interior for columns. It has been employed sufficiently to demonstrate its great solidity and strength, its increasing hardness beyond any natural stone, its resistance to cold at 16 degrees below zero, its capability to receive any required tint in color, and its cheapness against brickwork. This use of concrete has lately been familiar in cities for pavements which are exposed to the most severe action of frost. In its adoption we are returning not only to the examples of the ancients, but of modern Europe, where dwellings, bridges, and aqueducts are entirely built thereof."

The educational value of an institution of this kind is unquestionable—the architecture, archæology and the home life of the nations of antiquity and the middle ages will be brought forward in a wonderfully realistic manner. The gain would be great from an æsthetic point of view and the establishment of an institution of this kind would appeal particularly to the traveled and the cultured. The field is open to America to eliminate by reproduction from all the gathered material of the ages precisely what is wanted for a grand representation of the past and the present, and in its advocacy the enlightened press of this country has a cause worthy of its moral power, and in its aid wealth for its noblest use. The offices of the Propaganda for the National Gallery are located at 1419 F Street, Washington, D. C.

* Illustrated and described in SUPPLEMENT, No. 775.

Recent Decisions Relating to Patents.

ISSUE OF LETTERS.

The issuance of a patent to two persons, as joint inventors, constitutes *prima facie* proof that the invention was joint. 1.

Under Rev. St. § 4,896, which provides that, if an inventor dies before a patent is granted him, the right of applying for and obtaining a patent shall vest in his personal representatives, a patent issued to an inventor after his death, he having died after making application for such patent, is void. 2.

REISSUE OF LETTERS.

A reissue whose purpose is to enlarge the claims of the original, to be valid, must be for the same invention, and must show due diligence in discovering the mistake in the original, the lapse of two years being ordinarily taken as an abandonment of the new matter to the public. 3.

The claim of the original Topliff and Ely patent, No. 122,079, was for "separate rock rods, secured directly to the front and rear axles, to cause both ends of each spring to yield simultaneously." April 9, 1872, it was reissued, so as to claim "separate connecting rods secured directly to the hind axle and front bolster," etc. *Held*, that the reissue was valid, being allowed within four months, for the correction of a mistake which was obvious, since attaching the connecting rod to the front axle would prevent the axle being turned. 4.

The second reissue of this patent, granted March 28, 1876, is valid, as it is for the same invention, though the claim includes the side springs, and was applied for within two months from the first reissue, and before any rights of third persons had attached. 5.

PATENTABILITY—OPERATIVE DEVICE.

Letters patent No. 336,043, issued February 9, 1886, to Percival Everett, claims: "A weighing machine, having an aperture for receiving a coin, a weighted lever, a dial, and index hand, and intermediate mechanism connected with the same, and whereby the coin, when deposited in the receiver, shall operate the lever, and cause the hand to indicate the weight of the person or body being weighed." *Held*, that the claim is for the machine as a whole, having the parts mentioned, and as the patent refers to all parts necessary to make it complete and operative, the claim is to be read with reference to such known and described parts, and therefore covers an operative machine. 6.

NOVELTY.

Letters patent No. 386,458, to Vincent L. Ellbert, for an improvement in an apparatus for manufacturing water gas, describe, in claim 1, the combination of a combustion chamber, a superheater chamber, an arch located between the two, and provided with a series of legs forming separate passages leading from the combustion chamber to the superheater chamber, and a series of oil pipes opening through the outer wall of the cupola into the separate passages between the legs of the arch, substantially as described. *Held*, that this claim is void for want of novelty, in view of the prior state of the art, as shown by patents 253,120, 257,100, and 263,984, issued to Theodore G. Springer, January 31, April 25, and September 5, 1882, respectively, and by the "Jumbo cupola" used by the West Side Works, at Chicago, from 1883 to 1888. 7.

The first two claims of letters patent 345,186, issued July 6, 1886, to David F. Stauffer, for apparatus for treating unbaked bretzels, containing as elements the generator, the perforated pipe leading from near the bottom of the generator, a perforated spray pipe, and a casing located over the carrier, all of which elements, each operating in the same way and for analogous purposes, being shown in prior patents, and no new or better results being obtained, are void for want of novelty. 8.

Letters patent No. 323,162, issued July 28, 1885, to Emmit G. Latta, covering, in claims 2 and 3, a pedal bar coated with rubber, longitudinally grooved, so as to furnish two bearing surfaces on opposite sides of the groove, show no novelty over the English patents to Harrison (July, 1877) and to Jackson (January, 1876). 9.

1. Page Woven Wire Fence Co. *v.* Land, 49 Federal, 936.
2. De la Vergne Ref. Mfg. Co. *v.* Featherstone, 49 Federal, 916.
3. Topliff *v.* Topliff, 12 Supreme Court, 825.
4. Topliff *v.* Topliff, 12 Supreme Court, 825.
5. Topliff *v.* Topliff, 12 Supreme Court, 825.
6. Am. Auto. Weighing Mach. Co. *v.* Blauvelt, 50 Federal, 213.
7. Ellbert *v.* St. Paul Gas Light Co., 50 Federal, 205.
8. Stauffer *v.* Spangler, 50 Federal, 84.
9. Pope Mfg. Co. *v.* Gormully & Jeffery Mfg. Co., 12 Supreme Court, 637.

THE idea of using beet juices in steam boilers instead of water has again attracted some attention in Belgium. The juices are heated to 248° F., at which temperature there is no danger of sugar inversion. Steam obtained is used in regular way about the factory. The thickened juice is subsequently reduced to a sirup in triple effect.

PLACES VISITED BY COLUMBUS IN THE WEST INDIES.

The apparently exhaustive investigations which have been prosecuted within a few years past into all the details connected with the discovery of America by Christopher Columbus still leave much to be desired in the way of full and accurate information, such as is now everywhere sought, as we approach the four hundredth anniversary of that momentous event. There is no question, however, of the identification of the localities shown in our first page pictures, and their close association with the name and the doings of Columbus in all his voyages, which has made them memorable from that day to this. The pictures are from sketches drawn by our artist during a visit made a few years ago to these interesting localities, and offer a striking contrast to the scene which presented itself to the Spaniards on their first landing—their eyes meeting pictures of a wild luxuriance of tropical vegetation and dense populations in almost childlike helplessness, while the landmarks they left have to-day a mediæval appearance and a worn-out aspect suggestive rather of ancient than of modern history.

Four of the pictures are of Santo Domingo scenes, including the old fort, the ruins of the house built by Diego Columbus, and the cathedral where it is certain the body of Columbus long rested, and where it is claimed the remains now are. The city is on the right bank of the Ozama River, at its mouth, looking southward toward the Caribbean Sea. It is the oldest existing city founded by white men in the new world and was originally called New Isabella. Its population is at present about 6,000, and the ancient houses, such as are still standing, are remarkable for their solidity. Baracoa, where Columbus first landed in Cuba, and of which two views are given, is on the north side of the island, near its eastern end. The harbor is small but deep, and back of the town are high, craggy mountains of curious shape, the highest of which is called the Anvil of Baracoa. The houses are built of adobe, and the place is the center of a large fruit trade with the United States.

Columbus discovered the island of St. Domingo, or Hayti, on his first voyage. Exactly what land he first sighted in the early morning of the 12th of October, 1492, or about midnight between the 11th and 12th of October, has been a matter of a great deal of discussion. Five different islands are claimed as the locality of the first landing—Grand Turk, Mariguana, Watling, Cat, Samana—and in regard to none of them is the proof absolutely complete. On the third day, however, October 14, he lifted anchor, and for ten days sailed among the smaller islands of the archipelago. The Cuban coast was first struck on October 28, and then that of Hayti, on the northern side of which the ship of Columbus was wrecked, and out of her timbers was built a fort called La Navidad, where some forty of his men were left. With the rest of his company and the two smaller vessels the return voyage to Spain was commenced on January 4, 1493, Palos being reached March 15. The enthusiastic reception that was accorded him by the court and the people, the high-sounding titles with which he was honored, and the great excitement which his discovery aroused in all parts of Europe are familar to all, though it requires no little study and discrimination to understand just how the reports spread abroad about the new-found world presented themselves to different investigators.

The second voyage was commenced on September 25, 1493, when seventeen vessels, having on board some twelve hundred souls, set sail from Cadiz, Columbus this time being accompanied by his brother Diego and a number of persons of some distinction. On November 22, when La Navidad was again reached, it was found that the fort had been burned and the colony dispersed. A new settlement was at once begun, expeditions were sent inland to find gold, desultory mining operations were commenced, and twelve of the ships were sent home with captive Indians and products of the soil, Columbus himself continuing his explorations with three caravels, and discovering the island of Jamaica. At this time he supposed that Cuba was a part of the mainland of Asia, and forced his men to sign a paper to that effect. The government of Columbus over the new territories was unfortunate in many respects, and the adventurers who constituted the larger portion of the Spanish colonists were very turbulent, seeking mainly to find gold, and treating the natives with great harshness. Many charges against the management of Columbus were made to the home government, and he returned to Spain to answer them in June, 1496. He was received kindly at court, and, although enthusiasm in the new lands was declining, public funds were readily provided for another venture.

Columbus sailed from San Lucas, on his third voyage, May 30, 1498. He discovered Trinidad July 31, and skirted the northern coast of South America a short distance near the mouth of the Orinoco, thence returning to Hayti, when he found his colonists had established a fortified post and founded the town of Santo Domingo, his brother Bartholomew ruling there in his absence, and being succeeded by another brother, Diego. Detractors at home continuing to criticise Columbus, Francisco de Bobadilla was sent out to supersede him, arriving at Santo Domingo August 23, 1500, when Columbus and his brother were arrested and sent back to Spain in irons. This degradation caused a tide of feeling in his favor again, and a fourth expedition was readily provided for, although it was determined that Columbus should not again assume the government of the islands.

Columbus sailed from Cadiz on his fourth and last voyage, May 9, 1502, with four vessels, arriving at San Domingo June 29. On July 14 he sailed westward to find, as he supposed, the richer portions of India, naming many places which have been since renamed, and making a landing, August 14, on the coast of Honduras, thence following the coast down to Costa Rica, Columbus being ill in bed a great deal of the time. The natives here wore gold plate on their necks, and from a town called by the natives Veragua the descendants of Columbus years after borrowed the ducal title of his line. Columbus traced the Gulf side of the Panama Isthmus, little thinking how narrow a stretch of land separated him from the great ocean which lay just ahead of him before the real India was to be reached, of which he thought he had found a portion. There being indications of gold, from the articles made of the precious metal found in the possession of the natives, Columbus attempted to found two colonies on this coast—efforts which had to be abandoned on account of quarrels which arose with the natives—and on May 31, 1503, he sailed northward to Cuba and thence to Jamaica, where he beached his old and unseaworthy vessels in the harbor of St. Anne's Bay, in a small inlet still called Don Christopher's Cove. A year of disappointment, grief, and want followed, Columbus clinging to his wrecked vessels, and his crew mutinying and roving about the island. His needs were tardily supplied, but finally vessels were sent for him and his companions, and they were brought to Santo Domingo, where Columbus remained until his final departure for Spain, September 12, 1504. He reached San Lucas on November 7, lay ill for a time at Seville, and was received at court with but scant courtesy in May, 1505. While still hoping for a further commission to explore and govern new colonies in the seas over which he had four times sailed, the infirmities of age and the hardships he had endured brought him to his end on the 20th day of May, 1506, aged 70 or 71 years, the best authorities differing to this extent.

Diego Columbus, the ruins of whose house are shown in one of the views, succeeded to the governorship of the island in 1508, and his house was so strongly built that complaints were made that he was constructing a fortress, with the intention of declaring himself independent of the authority of Spain.

After the death of Columbus, at Valladolid, his remains were transferred to the Carthusian monastery of Las Cuevas, Seville, but they were exhumed not later than 1541, and taken to San Domingo, where they were interred in the cathedral, shown in one of the views. It was the wish of Columbus to be buried in this island, but the cathedral was not completed till 1540. In 1795 the town came into possession of the French, and the descendants of Columbus had permission to remove the relics to Havana, for interment in the cathedral there. The vault was somewhat hurriedly opened, however, and, although the after ceremonies were conducted with great state and ceremony, it is claimed that the remains thus transferred were those of Diego, the son, while the genuine remains of Columbus were left undisturbed in the cathedral at San Domingo. The matter has been the subject of a great deal of controversy, but cannot be said to have been satisfactorily settled.

The Electrification of Steam Jets.

In December, 1890, Mr. Shelford Bidwell exhibited some striking experiments before the Physical Society on the electrification of steam jets. The image of a jet was thrown upon the screen, and was seen to be practically transparent. Upon the jet being electrified, however, the image became immediately dark and dense. Mr. Shelford Bidwell stated that he had examined the absorption spectrum of the jet, and that when unelectrified there was very little action, but that electrification caused a total disappearance of the violet. He concluded that the observed effects were due to electrification increasing the size of the water particles contained in the steam jet. In a paper read before the Royal Society in March last, Mr. John Aitken traverses this conclusion, and enumerates a large number of facts tending to show that the dense form of condensation is not due to an increase in the size of the drops, but to an increase in their number accompanied by a diminution in their size. Lord Rayleigh's experiment showing that it is only very feeble electrifications which cause water drops to coalesce, while strong electrifications have the diametrically opposite effect, is also cited in support of the author's contention. Mr. Aitken remarks that it has been generally stated that the effect of the electrification is sudden and marked. If, however, the discharging point is extremely fine, or if we assist the discharge by means of a flame, then we may begin with electricity of a very low potential, and the increase in the density of the jet may be made to begin by almost imperceptible degrees.

Notes on Color.

The colors of the spectrum are arranged in a particular order, and this is found to be in the order of their wave length. Most of us at some time or other have been on the sea, or by the sea, and have noticed the waves rolling, one after the other, sometimes in quick succession, with only a few feet between the highest points of their consecutive crests, in other cases many yards between. Thus, as we note the quick and short waves, the length of the wave being taken as an imaginary straight line measured from crest to crest, and slow and long waves on the sea, so we find with light long and short waves; but it must not be supposed for one moment that the length of the waves of light are anything like the length of the waves of the sea. We have here to do with waves of almost infinitesimal length, yet these minute wave lengths have been accurately measured, and the results are expressed in "tenth metrets," or ten millionths of a millimeter, which is sometimes expressed as $\frac{1}{10^{10}}$ meters, or as $\mu\mu$. A millimeter is about one twenty-fifth part of an inch. In the spectrum the colors are arranged in the order of their wave length, beginning with the long waves of red, and passing gradually to the short waves of the violet. Unfortunately we find one defect consequent on the use of a glass prism, and that is that it compresses the space occupied by the longer wave lengths and unduly elongates that occupied by the shorter. To avoid this defect it has been customary to use, instead of the prism of the spectroscope, a diffraction grating, which is a sheet of glass or metal ruled with an exceeding great number of fine parallel equidistant lines; thus Professor Rowland has ruled concave diffraction gratings with 43,000 lines to an inch without an appreciable periodic error of one hundred-thousandth part of an inch; with these reflection or diffraction gratings a spectrum is obtained, which is called the normal spectrum, in distinction to the prismatic spectrum, or that yielded by prisms, and in the normal spectrum the colors will be arranged in equable manner with reference to their wave length.

The spectrum is supposed to be divided into 1,000 parts.

THE NORMAL SPECTRUM.

	Parts.
Red	330
Orange red	104
Orange	25
Orange yellow	28
Yellow	13
Greenish yellow and yellow green	97
Full green	87
Blue green	16
Cyan blue	51
Blue	74
Violet blue and blue violet	117
Pure violet	60
	1,000

If the room in which our spectrum is formed be well darkened, and we shut off the visible spectrum by receiving it on a piece of dead black paper, with very careful observation we can observe a continuation of the spectrum at each end, that beyond the red being a very deep red, or rather a chocolate, that beyond the violet a faint gray; the former are termed the infra-red, the latter the ultra-violet.

The existence of these invisible rays may be confirmed by two very simple experiments. Thus, by taking the infra-red first, we can prove their existence by moving a thermopile and galvanometer from the violet to the red end of the spectrum; as the thermopile advances along the spectrum the needle of the galvanometer will be deflected from zero, its normal position, more and more, till we pass beyond the end of visible red, when it reaches a point of maximum deflection and then gradually goes back to its original position. The existence of the ultra-violet rays may be proved in a somewhat different manner. It is easiest proved by using a solution of sulphate of quinine in dilute sulphuric acid, and diluting with water, or else by using an alkaline solution of æsculin—an active principle obtained from the horse chestnut. Having made our solution, it should be placed in a thin, white glass vessel, such as an ordinary test tube, and entering our darkened room, let us see what happens if we hold the test tube in the various colors of the spectrum. In the red, it appears red; in the yellow, yellow; in the green, green; in the blue, however, our solution begins to appear a peculiar bright blue, which increases as we pass through the violet, and still continues visible after we have left the violet and passed into the space where we suppose the ultra-violet rays to reside. Nor is this appearance visible only in the darkened room, but if the tube containing our solution is held in bright sunlight against a piece of black velvet, and looked at, not through, the peculiar blue shimmer, which is termed fluorescence, is plainly visible.—*Amateur Photographer.*

Diligence in Business.

In these days of hurry and strife for the firs' places in the race of life it is even more important than in former years that a man be diligent in his business and look after its every detail closely.

We see among our greatest business men of to-day those who started in life as poor boys and who have now become the heads of large establishments. How have they come to do this? Was it because they had better chances than are now held out to the average young man? That has not been so in the majority of cases, but they have striven after their high positions and have endured hardships to overcome obstacles. They have been diligent in business, and are now reaping a richly deserved reward.

In some respects it may be harder for a young man, or, in fact, any man in business, to make a great success, because of the amount of competition that has to be met. It needs men who will not give up for anything to battle against this competition.

Close attention must be given to the slightest details, and everything has to be done carefully. The cost must be measured in every transaction. Application is necessary if you would attain the best results.

Look out for the little things. They do not seem to count at the time, but every item helps to count up on either side of the balance sheet. By that it is not meant that one should be close, but he should be careful.

The "tricks of the trade" ought to be let alone. They do not help any in the long run. If a customer finds that he is not being treated fairly, he will leave in an instant. It is fair to say that there is very little underhanded business being done. It does not pay, and business men have come to see it.

Give all you can for the money, and you will hold a customer and gain others. Don't run down another man's stock in order to make a sale. If your neighbor has poor stock, the customer will find it out if he tries. Business men should work together as much as possible and try to make the standard of business principle as high as possible.

Let a man start out with fixed principles and with determination to win by the practice of fairness toward all, and he is bound to succeed. He needs to look out for his business and see that those under him are as honorable in every way. A man who does that will find friends both with customers and fellow business men.

All lines of business must be run systematically in order to attain the best results. It will not do to let one thing after another pile up until one is literally snowed under. It is best to go through with every thing in a systematic manner. Take up each item in its regular order and work while you work. Recreation that is taken when you are conscious that you have done the work of the day faithfully is always sweetest.

Always be on the lookout for chances to improve methods in business and keep up with the times in all lines. There are new articles coming up continually. Some of them possess merit and some do not. It is a study by itself to find out which are the best to handle. Much may be gained or lost in this respect.

There are numerous ways in which business must be watched. One must love the business he is engaged in, and seek to make it all that it should be. The mark of excellency cannot be placed too high. Reward for his labors is sure to come to the diligent man, and that was well known in the time of Solomon, who said: "Seest thou a man diligent in his business? He shall stand before kings; he shall not stand before mean men."—*Stoves and Hardware.*

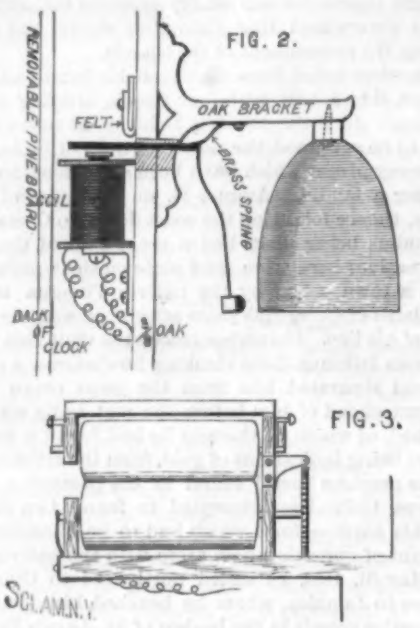
BOILS.—Dr. M. Spehn recommends very highly, as far superior to all other treatment, the use of chloral externally in this troublesome class of affections. He directs that the boil be kept covered with a tampon of cotton-wool soaked in the following solution:

℞ Chloral hydrat....... ʒ iss.
Aqua,
Glycerin...............aa f ʒ v.—M.

—*Amer. Med. Mag.*

CLOCK WITH ELECTRIC CHIMES.

We give an engraving of an electric chime clock made by one of the readers of the SCIENTIFIC AMERICAN, after instructions given in our issue of May 21, 1892, the builder of which informs us that it works well and gives him a great deal of satisfaction.



Figs. 2 AND 3.—DETAILS OF ELECTRIC CHIME CLOCK.

Owing to the fact that the bells procured by him were too small to receive the electro-magnets, he placed them outside of the bells, in the manner illustrated in Fig. 2, the bells being suspended from brackets attached to a board at the back of the clock, the electro-magnets being secured to the rear surface of this board. The armature lever is attached to a spring, which serves as a pivot, and also retracts the armature after it has made a stroke. A small disk of felt is secured to the pole of the magnet and a loop of felt is attached to the back board. The armature plays between these two pieces of felt, and is, therefore, noiseless in its operation. The upper roller of the pair which moves the perforated paper is supported in an overhanging frame, as shown in Fig. 3, so that an endless piece of music can be slipped between the rollers and played over and over.

The clock movement is an 8-day lever movement. This, being a compact form of clock, affords ample room for the favorable disposition of the bells and machinery. The case is of very neat design, made entirely of quartered oak, well filled and finished. The glass doors and sides are beveled. Taken altogether, it is as fine a piece of hall, dining room, or parlor furniture as one would wish to have.

We regret that the maker of this creditable piece of work insists upon withholding his name. His reason is that he has found by experience that when he furnishes a popular article to the SCIENTIFIC AMERICAN he requires a secretary to reply to the almost endless number of queries which such an article provokes.

Fig. 1.—ELECTRIC CHIME CLOCK.

Saccharin in a New Role.

This new substance is growing in importance in proportion as new uses are being discovered for it, and this is of constant occurrence. The fruit-preserving industry has been hitherto checked by the association with microscopic organisms attached to the skin of some fruits, and which, when brought in contact with cane sugar, is apt to ferment the latter. To prevent this chemical action, fruit bottlers have found it necessary to add an excess of sugar, or to raise the fruit to a high temperature, to kill the germs of fermentation. Both processes are attended with injury to the flavor of the fruit, and it has been recently discovered that this result can be prevented by the use of saccharin. When used alone it is claimed that perfect sterility is secured by simply raising the temperature of the bottled fruit to 180° Fah. for about two hours and a half. The proper proportion of saccharin for this purpose is one and one-fourth ounces to four gallons of water. It is claimed for this process that it preserves the flavor as well as the color and form of the fruit better than the old method of preserving with sugar. This discovery comes to us so well indorsed that we hope those of our readers who are interested in the subject will test it and report results. If it is all that is claimed for it, it is a discovery of no little importance, or, at least, is worth trying.—*Confectioners' Journal.*

Cold Storage for Salmon.

It is well known that by arrangement among the salmon packers on the Pacific coast the catch of salmon has been restricted to the requirements of the market under existing conditions, says the California *Fruit Grower*. Better facilities for preserving the fish are now being realized, with the result that this delicious food fish is likely to find a much wider distribution in a fresh state than ever before. Late dispatches from Victoria, B. C., announce that a cold storage system has lately been completed by San Francisco parties for the Cunningham cannery on the Skeena River. Into these refrigerators the fish are placed as soon as taken from the water and subjected to a temperature of 20° below zero. Here they remain six or seven hours, and are then removed to another room with a zero temperature, where they are held some two weeks, and then hermetically sealed in cases for shipment. The general introduction of cold warehouses adjacent to the fishing grounds is destined to effect a notable change in the salmon industry, enabling canners and others to utilize the heaviest runs, instead of being restricted in their catch to the number they are able to use up from day to day. The fish may now be caught in larger quantity and stored in cold rooms for future treatment in the intervals between large "runs."

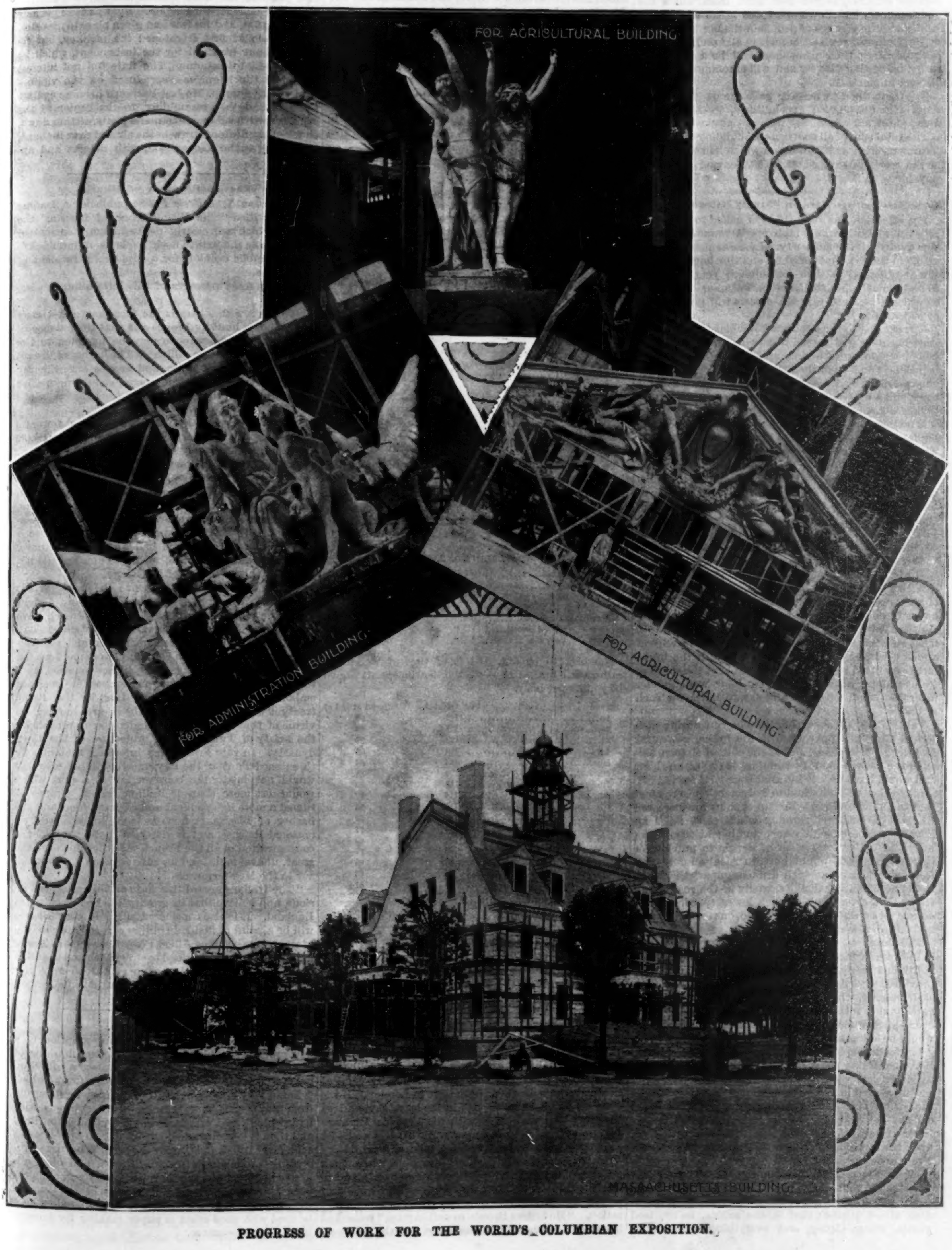
AN electric flying machine was recently made to rise 70 feet and fly about 400 yards.

THE GREAT EXPOSITION.

Our illustrations herewith, of three groups by different sculptors, for the ornamentation of the Agricultural and Administration buildings, afford only a suggestion of the great wealth of artistic work of a high character now approaching completion and being placed in position on the several structures which have so quickly sprung into being upon the exposition grounds. The great buildings afford an almost unlimited field for the architect and the artist, which is being availed of to complete the buildings with a richness and appropriateness of decoration that seems little short of marvelous, considering the shortness of the time allowed for the work, and which will effectually put out of the mind the temporary character of most of the structures.

The state of the work upon the Massachusetts building gives a fair idea of the condition of forwardness exhibited also by many other State structures, on all of which operations are being conducted with an energy which gives every promise of their completion in ample time to serve the purposes designed as adjuncts of the great exposition. Structures for the use of the officials and visitors from Illinois, Kansas, West Virginia, Rhode Island, Massachusetts, Connecticut, New Hampshire, Iowa, Maine, Arkansas, Indiana, Ohio, Pennsylvania, Nebraska, Montana, Maryland, and Delaware, were inclosed and roofed before the middle of September.

For some time past preparations for the dedicatory ceremonies have been engrossing the attention of the exposition authorities to the exclusion of almost everything else. The number of invited guests (about 100,000) is so large that it will be impossible to admit the general public to the grounds. Chairs have been provided for 90,000 people in the Manufactures build-



PROGRESS OF WORK FOR THE WORLD'S COLUMBIAN EXPOSITION.

ing, and there is standing room for 85,000 more. There is to be a chorus of 5,000 singers and an orchestra of 300 pieces.

This great building, in which the exercises are to be held, faces the lake, and has four great entrances in the manner of triumphal arches, the central archway of each being forty feet wide and eighty feet high. The long array of arches and columns is relieved from monotony by elaborate ornamentation, so that every part of its great length presents new and interesting features. A fifty foot gallery extends around all four sides of the building, and from this extend eighty-six smaller galleries, twelve feet wide, from which the sightseer may look down upon the great array of exhibits and the throngs of people in the big hall below.

The main railway station, where all excursion trains will discharge their passengers, will be a handsome structure costing $225,000 and will accommodate 25,000 persons at one time.

The report of the auditor gave the receipts up to Aug. 31 as $10,401,045; expenditures, $8,743,259; balance, $1,657,785.

The total sum of all contracts for buildings and other improvements was $9,981,372, on which had been paid, as the work progressed, $5,219,550, leaving a balance payable of $4,761,821.

Geo. Westinghouse, Jr., on "Ninety Miles an Hour."

My attention has recently been called to an article relative to brakes and high speed trains in which I was quoted as the authority. In consequence of the errors in the article referred to, and the importance of the questions raised, I desire, through your columns, to state some important facts bearing upon the subject, to which I am sure railroad officers will give careful consideration.

By referring to the celebrated Douglas Galton brake experiments it will be seen that, with the brakes in the best possible order, acting upon all of the wheels of one vehicle and up to their theoretical efficiency, it was only possible to reduce the speed at the rate of about three and a half miles per hour for each second the brakes were applied until the vehicle stopped; and it was further found, during these experiments, that the higher the speed, the less the brakeshoes retarded the wheels with a given force applied to them; and that at 60 miles and upward, the brake force to be thoroughly efficient would have to be at least double that now usually employed in daily practice at speeds below 50 miles. With trains of considerable length it was shown that, with the brakes in the most perfect order possible, trains could be brought to stand from a speed of 60 miles an hour within about 1,200 feet, the brakes in these cases acting upon about 95 per cent of the weight borne by the wheels of the train.

With a *perfect brake*, acting upon all of the wheels of an express train running at 90 miles an hour, it will be seen from Table No. 1 that at the end of ten seconds the train would still be moving at a little over 60 miles an hour, and would have traveled a distance of about 1,130 feet. As a matter of fact, with the brake force now fitted to trains, the reduction of the speed of trains running above 60 miles an hour would, under favorable conditions, not exceed two miles for each second.

Table No. 2 will show the distance run during each second after the application of the brake, *under the best actual conditions*, and at the end of sixteen seconds the train would be running] 61 {miles an hour and would have traveled in that time 1,796 feet.

It requires no more than to call attention to the fact that the human vision is limited to show the increased risk that is incurred running trains at 90 miles an hour, as compared with trains running at 60 miles an hour and under. A system of signals to provide for these high speeds would have to be absolutely perfect, and arranged at such distances apart that they would necessarily limit the capacity of the road for all trains that are run at a much lower speed, unless a double set of signals were provided, one for high speed and one for low speed.

The danger to a person crossing the tracks at a level with trains running at these high speeds would be multiplied many times, unless a system of gates were provided, with danger signals at nearly a mile from each crossing, which could only be lowered when the gates at the crossing had been properly closed; in fact, everything would have to be arranged so that nothing would be left entirely to the judgment of man.

It was the explanation of these points in a conversation, concerning the running of trains at high speed by electricity, with a writer of a daily paper, who was interested in the subject, which probably formed the basis of the article to which my attention has been called. It may, therefore, not be out of place in this letter to state a few facts which will bear with force upon the question of substituting an electric locomotive for the present steam locomotive.

Electricity on Standard Railroads.—The modern passenger locomotive, for high speed trains, must be capable of developing at least 1,200 horse power, and it costs about $10,000; that is, the engine, boiler, feed pumps, steam piping, and everything necessary to produce motion cost about $8 per horse power. For the operation of a train by electricity, in place of one steam locomotive there would be required the following principal items, costing, according to present prices of electrical apparatus, approximately the figures set opposite:

A stationary steam boiler, 1,600 horse power	$16,000
A stationary engine, 1,600 horse power	18,000
An electric generator, 1,600 horse power	25,000
Motor for locomotive, 1,400 horse power	22,000
	$81,000

In addition to the above there would have to be added the proportionate cost of the buildings and outside electrical construction for the transmission of the electricity from the generator to the locomotive.

There are innumerable places where electrical power will profitably supplant the steam engine, but I feel confident that the above figures, or any modification that may reasonably be expected, will be a most serious obstacle to the utilization of electricity for moving standard railroad trains, even provided all of the mechanical details necessary for the transfer of electrical energy of 1,200 H. P. from a stationary to a moving object shall be satisfactorily worked out.

GEO. WESTINGHOUSE, JR.

TABLE NO. 1.

Speed	90	miles per hour.
Feet per second	132	
Time lost applying brakes	1	second, with full application at end of second second.
Reduction first second	0	miles.
" second second	1¾	"
" each second after	3½	"

With the above condition, the following figures are almost accurate (fractions omitted):

Seconds.	Feet traveled.	Speed at end of
1st	132	90
2d	131—	88¼
3d	126—	84¾
4th	121+	81¼
5th	116+	77¾
6th	111+	74¼
7th	106+	70¾
8th	101+	67¼
9th	96+	63¾
10th	90+	60¼
Total run	1,130	feet in ten seconds.

To obtain the above results upon dry rails and upon the level would require a brake force of at least three times the total weight of the train, and this should be properly distributed upon every wheel in the train, and there would be needed a device on each car to automatically reduce the brakeshoe pressure as the speed decreased.

TABLE NO. 2.

Speed	90	miles per hour.
Feet per second	132	
Time lost applying brakes	1	second, with full application at end of second second.
Reduction first second	0	miles.
" second second	1	"
" each second after	2	"

The best to be expected from present well-fitted trains, with brakes in perfect order, in speeds above sixty miles per hour.

Seconds.	Feet traveled.	Speed at end of
1st	132	90
2d	131	89
3d	129	87
4th	126	85
5th	123	83
6th	120	81
7th	117	79
8th	114	77
9th	111	75
10th	108	73
11th	105	71
12th	102	69
13th	99	67
14th	96	65
15th	93	63
16th	90	61
Total run	1,796	feet in 16 seconds.

—*Railroad Gazette.*

The Musical Orang-Outang.

A correspondent of the *Spectator*, who has been making experiments with various musical instruments on the animals at the Zoological Gardens, writes as follows with regard to one of his latest tests:

Our first visit was paid to "Jack," the young red orang-outang, which, since the death of "Sally," the chimpanzee, claims the highest place in animal organization among the inmates of the Zoo. He is a six-months' old baby, of extremely grave and deliberate manners, and perhaps the most irresistibly comical creature which has ever been seen in London. He is extremely well behaved, not in the least shy, and as friendly with strangers as with his keeper. His arms are as strong as those of a man, while his legs and feet seem to be used less for walking than as a subsidiary pair of arms and hands. He is thus able, when much interested, to hold his face between two hands, and to rest his chin on a third, which gives him an air of pondering reflection beyond any power of human imitation. "He knows there's something up," remarked his keeper, as we entered the house, and the ape came to the bars and sat down to inspect his visitors. As the sounds of the violin began, he suspended himself against the bars, and then, with one hand above his head, dropped the other to his side, and listened with grave attention. As the sound increased in volume, he dropped to the ground, and all the hair on his body stood up with fear. He then crept away on all fours, looking back over his shoulder like a frightened baby; and taking up his piece of carpet, which does duty for a shawl, shook it out, and threw it completely over his head and body, and drew it tight round him. After a short time, as the music continued, he gained courage and put out his head, and at last threw away the cloak and came forward again. By this time his hair was lying flat, and his fear had given place to pleasure. The piccolo at first frightened the monkey, but he soon held out his hand for the instrument, which he was allowed to examine. The flute did not interest him, but the bagpipes—reproduced on the violin—achieved a triumph. He just flattened his nose against the bars, and then scrambling to the center of the cage, turned head over heels, and lastly, sitting down, chucked handfuls of straw in the air and over his head, "smiling," as the keeper said, with delight and approval.

The Fortification of Biserta.

The Vienna *Neue Freie Presse* publishes a leading article entitled "The War Harbor of Biserta," the facts in which are clearly derived from a competent source, while the article itself reads as if intended to prepare public opinion for a diplomatic incident of importance.

I subjoin some passages of this interesting communication:

"To begin with, there is the fact that a first class war harbor is built by France and that the balance of power in the Mediterranean may be modified to the prejudice of the Triple Alliance. The harbor of Biserta is only 18 hours from Malta, and France has evidently been bent on rendering it impregnable. Modern ships of war can reach the Sicilian coast from Biserta in one night.

"After the occupation of Tunis, France formally promised not to transform Biserta into a war harbor, professing to have only commercial objects in view. In 1886 a French military commission inspected the coast, and a little later a plan for the coast defense was elaborated in Paris. The French government then sent engineers to Biserta and secretly took surveys, which were followed by the first diplomatic representations of the British government; yet the French cabinet still denied that it had any evil intentions. It did not feel firmly established in Tunis and did not yet enjoy the patronage of Russia.

"When France began to receive the Czar's favor it proceeded with more assurance. Plans and designs have once more been produced, and the French have begun to build a war harbor of the largest dimensions. The English and Italian remonstrances, and also certain representations from Germany, were met by a flat denial. A period of persistent silence followed, until the change in the situation brought about at Cronstadt emboldened France to contend that by the Bardo treaty it was entitled to build the Biserta harbor. In virtue of that treaty France undertook to provide for the safety of Tunis and the protection of the Bey's dynasty. In vain France was informed that nobody threatened Tunis or the Bey, and that in any case that would not justify the construction of a port which would cost more than 15 million francs. France assumed a more independent and off-hand tone, and the harbor of Biserta is now declared to be a work of national defense, and is destined to be the point of concentration of all the French maritime forces in the great, unavoidable, and decisive struggle for supremacy in the Mediterranean. . . .

"The Italians regard this state of things as most serious, and believe that its gravity will be recognized in England. It is also considered in Berlin that Biserta will be a point of first-rate military importance in case of war with the three Allied Powers. Thus the Tunisian question seems destined to strengthen and maintain the Triple Alliance, and the fate of Europe may possibly be decided in the Bay of Carthage."—*London Times.*

Silky Paper.

In *L'Industrie Textile* appears a description of a new product capable of being used in the finishing of textile fabrics and of imparting thereto a silky appearance. This product is the mineral antonite which is found very largely in California in masses varying from gray to yellow. This mineral is first treated with hydrochloric acid, which dissolves out all impurities, and then it is well washed with water to free it from acid, after which it is ready for use. The next proceeding is to mix it with glue, starch, and other adhesive bodies, and use it in the ordinary way of finishing materials; the sized fabric can then be sent through the calenders to give it a gloss. The new product may be used with good effect in paper making for imparting a silky appearance.

An Ancient Birdland.

For ages before its occupation by man New Zealand swarmed with great wingless birds, which found here no carnivorous enemies, but an abundance of vegetable food. The moas not only existed in vast numbers and for thousands of years, but had such diversity of form as to embrace no less than seven genera, containing twenty-five species—a remarkable fact which is unparalleled in any other part of the world. The commonest kinds in the North Island were only from two and one-half to four feet high. Those of the South Island were mostly from four to six feet tall, while the giant forms, reaching twelve and thirteen feet, were always rare. Immense deposits of moa bones have been found in localities to which they appear to have been washed from the hills in tertiary times. Skeletons on the surface of the ground, with skin and ligaments still attached, have given the impression that these birds have been exterminated in very recent years, but other facts point to a different conclusion. Tradition seems to show, according to Mr. F. W. Hutton, that the moa became extinct in the North Island soon after the arrival of the Maoris in New Zealand—that is, not less than 400 to 500 years ago—and in the South Island about a hundred years later. The fresh-appearing skin and ligaments are supposed to have been preserved by unusually favorable conditions.

THE GREAT-HEADED TURTLE.

The great-headed turtle (*Platysternum megacephalum*) is an inhabitant of the rivers of Tenasserim, Siam and Burma, but is very rare even there. Its shell is remarkably broad and flat. The entire length of the turtle, when stretched out to its fullest extent, is about 15 inches, one-third of this length covering the head and neck, while the tail is about 7 inches long. The size of the head, compared with that of the body, is very remarkable, there being only a few birds and fishes in which such a lack of proportion is found. Our illustration is from Brehm's "Thierleben."

GREAT-HEADED TURTLE (*Platysternum megacephalum.*)—(One-half natural size.)

A Postal Nickel-in-the-slot Enterprise.

The United States Postage Stamp Delivery Company, of Boston, has placed upon the market a nickel-in-the-slot system of selling postage stamps which has many novel features. It consists of a machine provided with two apertures near the top to receive the nickel. The one on the left is for two cent stamps, while the one at the right is for one cent stamps. When a nickel is dropped in the slot the mechanism releases one of the drawers, which contains a cartouch, or small cylindrical box, inside of which, snugly rolled up, are four cents' worth of stamps, either two twos or four ones, depending upon which side received the nickel. In addition to the four cents in stamps, there is a "coupon draft," which will be received as one cent in ten of the purchase money of any of the articles mentioned in the thirty-two advertisements on the draft, so that if any of the articles named are purchased, the stamps will be furnished without charge.

As an advertising medium, the new system will be very valuable, as the advertiser can judge each day by the number of coupons received whether or not the boxes are a good advertising medium. It may be remarked that only staple articles, or articles which allow a good margin of profit, are expected to be advertised. The boxes are to be placed in a certain district, and the advertiser pays a small sum each month for each box containing his advertisement. It is intended to be largely used by wholesalers, manufacturers, etc., who will receive the drafts from the retailers who sell the goods which they advertise. The whole system appears to be very carefully worked out, and is under the control of an able management, the president being Hon. Carroll D. Wright, United States Commissioner of Labor, and the vice-president Hon. Smith A. Whitfield, First Asssistant Postmaster-General.

The St. Gervais Disaster.

The geologists who have investigated the cause of the great disaster which overwhelmed a part of St. Gervais, Switzerland, with ice and water from the lower part of the Bionassy glacier, have solved the mystery. Up the side of the mountain, at the foot of the steep glacial wall whose lower part broke away, the explorers found in the ice an oval cavern about 130 feet in width and 75 feet in height. In the interior of the cavern was a corridor covered with blocks of ice and leading into a gigantic basin with perpendicular walls of ice. It was 45 feet long, 200 feet wide, and 140 feet high. In this great cavity there had been an intra-glacial lake, of whose existence no one had been aware. The condition of the walls proved that the cavity had been full of water recently.

The existence of this great reservoir of unfrozen water, inclosed on all sides, explains the nature of the immense avalanche that overwhelmed the valley below. The excessive heat for days before the disaster had probably increased the quantity of vater in the natural reservoir, and the greater pressure broke the front wall, cracking away the lower part of the glacier, and permitting the immense volume of water to pour down the mountain into the valley below, carrying with it the broken foot of the glacier. The water and ice fell a distance of 2,000 feet down an inclined plane two miles long, and a part of St. Gervais had been overwhelmed almost before any one heard the roar of the approaching deluge.

This is the only accident due to such a remarkable cause ever known in the Alps. It has been followed, however, by a somewhat similar accident at the Misaun glacier, near Pontresina. A considerable part of this short, steep glacier fell, and, although there was no loss of life, the accident draws attention to the fact that all over the Alps climbers have recently noticed a swelling of the upper snows which feed the glaciers. They report that not a few of the glaciers have been impassable without great risk this season, and that the upper edges of the great crevasses have overhung in a remarkable manner. These facts point to an expansion of the upper snow field by great heat, and before the past season was more than half over climbers were warned of this fact, which was doubtless the cause of many avalanches.

A fall of ice from one of the glaciers in the Valley of Visp partly destroyed the village of Tasch, near Zermatt. It carried away nearly a quarter of a mile of the highway. The waters of the Viege torrent, swollen by melting snow from the mountains, attacked the stone bed of the Viege-Zermatt Railroad and destroyed a large section of the line. For a number of days tourists going to Zermatt were transported on mules around the break.

Bread and Yeast.

Put a bushel of flour into a bread trough, make a bay or hole in the center of it, and put in one pint and a half of patent yeast, and the same quantity of lukewarm water; mix this with a portion of the flour to the consistence of rich cream; dust flour over it, cover with a cloth, and allow the sponge to rise. When well risen and light, add two tablespoonfuls of fine salt, and mix all together with sufficient lukewarm water to form a rather stiff dough; cover it again and let it rest for half an hour, then knead it well, and let it stand for another hour, after which make it out into suitable loaves and place them in pans, and bake them on the bottom of a quick oven.

For large bakings, the following is the best method: The usual way is to put the flour into a trough or tub sufficiently large to permit its swelling to three times its original size or bulk; make a deep hole in the middle of the flour; for each half bushel of flour allow a pint of thick, fresh yeast, that is, yeast not frothy; mix it with about a pint of soft, lukewarm water, then gently mix with the yeast and water as much flour as will bring it to the consistence of thick batter; pour this mixture into the hole in the flour and cover it by sprinkling it over with flour; lay over it a flannel cloth, and, in cold weather, place it near the fire. This is called setting the sponge. When the sponge, or this mixture of water, yeast, and flour, has risen enough to crack the dry flour, by which it was covered, sprinkle over the top a quarter of a pound of fine salt, more or less, to suit the taste. After the salt is sprinkled over the sponge, work it with the rest of the flour, and add, from time to time, tepid water till the whole is sufficiently moistened. The degree of moistness, however, which the mixture ought to possess can only be learned by experience. When the water is mixed with the composition then work it well by pushing your fists into it, then rolling it out with your hands, folding it up again, kneading it again with your fists till it is completely mixed and formed into a stiff, tough, smooth substance, which is called dough. Great care must be taken that your dough be not too moist on the one hand, and on the other hand that every particle of flour be thoroughly incorporated. Form your dough into a lump, cover it up again, and keep it warm to rise or ferment. After it has been standing for about twenty or thirty minutes, make the dough into loaves, first having dusted the board or table with flour to prevent sticking. The loaves may be made up in tin moulds, or they may be baked without the use of moulds. The bread will take from an hour and a half to two hours to bake properly.

PATENT YEAST.

Take half a pound of hops and two pailfuls of water; mix and boil these till the liquid is reduced one-half; strain this decoction into a tub, and, when lukewarm, add half a peck of malt to it. In the meantime put the strained-off hops again into two pailfuls of water and boil as before till reduced one-half; strain the liquid while hot into the tub. The heat will not injuriously affect malt previously mixed with tepid water. When the liquor has cooled down to about blood heat, strain off the malt and add to the liquor two quarts of patent yeast set apart from the previous making.—*Confectioners' Journal.*

The Alternating Current Telephone.

In a patent lately issued to Prof. Elihu Thomson, this well known inventor describes a system of telephone in which alternating currents are employed in the primary of the induction coils to which the transmitter is connected instead of continuous currents, as now generally employed. In applying the alternating current for this purpose, Prof. Thomson employs such a low rate of alternation as not seriously to interfere with speech.

The alternations, generated by an alternator, are induced into the subscribers' lines and form the means for transmission from the subscribers' lines to other subscribers' lines, to which they may for the time being be connected through the exchange. The rate of alternations is as low as 32 vibrations per second, and even those below sixteen vibrations per second are available. These rates of vibration or alternation are so low that although the instruments are subjected to them they do not seriously interfere with speech, as the tone they produce is almost inaudible, on account of the small volume of air set in motion by the diaphragms of the instrument.

By means of this system, all local batteries at the subscriber's end of the line are dispensed with, and the system is, as it were, a closed circuit system possessing great flexibility. The system also permits the working of the annunciators at the exchange by the subscriber momentarily opening the line by a switch, or, better, by the simple act of lifting the telephone from the hook, while the replacing of the telephone on the hook again signals the exchange that the use of the line is discontinued. The system also provides circuits, so that there shall not be any circuits actually grounded, as connections to earth through condensers may be made instead of returning through a continuous conductor or a metallic circuit connected to earth, such as is ordinarily employed.

French Exposition of 1900.

The French *Journal Officiel* has published a decree ordering a universal exposition of arts and manufactures, to be opened in Paris May 5, 1900. It would seem from this announcement that France has decided to have a universal exposition every eleven years, for there was one in 1867, 1878, and 1889. The decree states that the exposition of 1900 will be fully representative of the art and philosophy of the nineteenth century.

RECENTLY PATENTED INVENTIONS.

Engineering.

BALANCED SLIDE VALVE.—Martin A. Green, Altoona, Pa. This valve has a pressure plate with an internal steam space and with portions resting on the valve seat to prevent undue pressure upon the valve, there being a balance ring fitted in the pressure plate and resting against the casing plate, which is disconnected from the pressure plate. The casing plate may be removed to permit access to the balance ring without removing the pressure plate, and the latter is movable laterally over the valve and seat, so it may be properly set without varying the tension of the spring interposed between the balance ring and pressure plate.

SMOKE AND SPARK ARRESTER.—Edson J. Hadlock, Big Spring, Texas. This is an improvement on a former patented invention of the same inventor, providing an apparatus designed to be economically applied to a common locomotive, for arresting and consuming the smoke and sparks. The construction is such that the products of combustion pass to a box on an extension front of the locomotive, where the light smoke is discharged by an escape stack, while the cinders are deposited and the other products of combustion are passed rearward to the fire box through return smoke pipes on each side of the locomotive.

Railway Appliances.

CAR COUPLING.—James M. Elliott, Jr., Gadsden, Ala. Two patents have been granted this inventor for improvements in couplers of the Janney type, in which a knuckle or coupling hook is fulcrumed about a vertical axis in one side of the drawhead, to engage a similar knuckle on the opposite drawhead. One of the patents covers a peculiar construction and arrangement of the rear portion of the knuckle and the drawbar and the means for locking the knuckle in closed position, while the other patent provides a peculiar arrangement of the axial pin, a spiral spring surrounding it and the knuckle. Effective means are thus afforded for positively throwing the knuckle out to its open or uncoupled position in an automatic manner when the cars are separated, to be ready for automatic coupling again without readjustment of the knuckle.

SWITCH SHIFTER.—John Gilstrap and Martin L. Brown, Moscow, Idaho. This invention provides a simple and positive apparatus by which a railway switch may be operated from a moving train, crank shafts parallel with the track being connected with the switch bar, transverse shafts being geared to the crank shafts, while gear wheels on the transverse shafts have oppositely arranged lugs, and weighted levers pivoted on the shafts swing between the lugs, the swinging levers being designed for engagement by sliding bars on the locomotive.

Mechanical.

GRINDING MACHINE TOOL REST.— Darwin L. Brown, Detroit City, Minn. This is a simple and durable rest, arranged for conveniently and accurately grinding tools used by engravers, carvers, watch makers, etc. A bar is adapted to extend across the face of the grinding wheel, at angles to the face of which the bar is formed with shoulders and grooves, the latter being of varying sizes and depth to accommodate the different tool shanks. The tool, pressed with its end against the face of the grinding wheel, has its end ground to a bevel corresponding to the angle formed by the face of the bevel of the groove.

Agricultural.

SEED PLANTER.—Ebenezer R. Knight, St. Johns, Canada. This is a broadcast sower, with a seed box carried by a wheel-supporting frame, there being a valved chute in the center of the box, beneath which revolves a seed delivery drum or cylinder having peripheral grooves or pockets. The implement is of simple and inexpensive construction, for sowing any kind of seed that is to be scattered broadcast, the seed being protected in windy weather when dropping to the ground, and a storage compartment being provided whereby the seed may be carried in bulk to the field without danger of spilling.

Miscellaneous.

ROAD SCRAPER.—John S. Palmer, West Duluth, Minn. The several scraper bars of this machine are hinged to a rod mounted upon the main axle. The scrapers are arranged in a series, their blades parallel with a rigid diagonal brace and supporting beam, and each scraper consists of a bar hinged at its forward end (the bars being of different lengths), while its rear end has a downwardly extending flange to which is bolted the blade. Each blade has an inwardly projecting lip at one end, the lips overlapping, so that the space between the blades is closed to prevent the rearward passage of dirt. By means of a novel arrangement of spring bar and operating lever, the entire weight of the machine may be made to rest upon the blades, or a less weight, as desired.

DERRICK DRUM.—Adams C. French, Rapid City, South Dakota. The drum proper, according to this improvement, has at one end a receiving portion or section, to receive surplus cable, this section adjoining the main windlass portion, on which the strongest pulling is done. A plate separates the sections, and has a slot through which the cable is passed from one section to the other, whereby any desired length of cable may be paid out, and the winding and unwinding effected without frictional wear upon the collected rope. The drum is formed of two concentric sections, one larger than the other, the larger receiving cable from the smaller sections.

STRAP FOR BUNCHING LUMBER.—Edward C. Binet, Clipper Mills, Cal. This improvement provides a metallic band having barbs designed to engage the outside portions of separate pieces of bunched lumber formed into bundles, the barbs being so shaped as to lock fast to the material, and thus form a reliable binding strap. The end barbs are furnished with a peculiarly shaped locking prong adapted to interlock with the bunched material when driven therein, the strap being thus well adapted to hold in closely bound condition planed boards or similar material, to facilitate handling, counting, etc.

DRYING STOVE FOR BRICKS, ETC.— Albert Schaaf, Halle, Germany. Combined with the drying flue of this stove or furnace is a series of depending transverse curtains, while over the curtains extends a strand, short cords from which connect all the curtains for simultaneous operation. The curtains serve to regulate the currents of air and are adjustable, so as not to touch the articles. The furnace is designed to utilize the heat to the fullest extent in drying brick, ceramic articles, etc., conducting the warm dry air in divided currents along every article treated, and into uniform contact with the whole free surface of every object to be dried.

ICE PLOW.—Hamilton Pray, Clove, N. Y. This plow has two principal longitudinal beams so connected that they may be adjusted nearer together or farther apart, according to the width of the ice blocks to be cut, a clip held on the beam carrying a transverse bolt extending through the beam, a cutting blade pivoted on the bolt having an extension adapted to be secured to the beam. The invention is an improvement upon a former patented invention of the same inventor, providing a simple and durable construction designed to prevent breaking of the cutting blades and beams.

FOOT FOR DREDGE ANCHORS.—William Pike and Norman McDairmid, Sault Ste. Marie, Mich. Combined with the anchor post is a foot having swinging leaves, open-topped boxes being secured to the leaves, while a cross bar secured to the rigid portion of the foot extends into the path of the boxes. Cables secured to the leaves extend upward to the top of the post, and a counterbalance is secured to the cables. The anchor foot being made in hinged sections, when the dredge moves off the center the foot partially closes, overcoming the suction, so that it may be easily worked loose and raised.

GRAIN DUMP.—John P. Peterson, Worthington, Minn. This invention provides an inexpensive structure, so built that the pit to receive the grain need not be sunk in the ground, or may be sunk only a little, the parts being so arranged that dust or foreign matter, fluid or solid, will not interfere with the action of the dump timbers in cold weather. The dump timbers are pivoted in openings of a platform, beneath which is a shaft having arms connected with the timbers, an operating lever, and locking arms connected with the arms of the shaft to engage the platform. The vehicle is driven upon the platform, and by rocking the shaft the timbers, including the vehicle, are inclined to facilitate depositing the load.

SANITARY PAIL.—Charles Baron, New York City. This is a very simple and comparatively inexpensive vessel, that may be conveniently used in any household. It has a cover which may be removed from, or held in locking engagement with, the body, and the pail is fitted for use as a commode when desired.

CARPET STRETCHER.—Robert Harrison, Philadelphia, Pa. This device has an arched body terminating at its forward end in a jaw, a second spring-pressed jaw being pivoted upon the body and adapted for engagement with the fixed jaw, while feet have adjustable connection with and act as fulcrums for the body. The device is designed to be easily and quickly manipulated, so that the carpet, with the stretcher, may be carried directly to the base board of a room.

STIRRUP.—Robert H. Dacus, Dardanelle, Ark. This is an improvement in wooden stirrups, the suspension bar being centrally held parallel with the sides of the stirrup, and being supported in position by cross bars by which the upper ends of the sides of the stirrup are held spaced apart. The suspension bar and transverse cross bars may be either of wood or metal.

PIANO ATTACHMENT.—Henry A. Hauff, Brooklyn, N. Y. This is a simple apparatus designed to be applied to any piano to cause a beginner to mechanically hold the wrists and hands in proper position for correct playing, the apparatus being adjustable to suit people of any size. It consists of two notched bars held by suitable attaching devices to extend out and up from the ends of the keyboard, these bars supporting a cross rod, the wrists of the player when touching or a little above the cross rod being in the proper position for playing.

COMB.—Elmira H. Harpham, St. Louis, Mich. This is a back comb for ladies' use, combining a comb for holding the back hair neatly and in position when "done up," and an attached neck comb for keeping up neatly the neck hairs or locks; there is also combined therewith a hair dart or pin to pass through the hair and aid to hold the combined comb in place, the whole forming a useful and ornamental article for ladies' head wear.

MUCILAGE HOLDER.—Frank H. Palmer, Brooklyn, N. Y. This is a device designed for pocket use, and is arranged for conveniently gumming at all times papers, envelopes, stamps, etc. It consists of a wooden casing in pencil form in which is fastened a stick of mucilage, one end of which projects at one end of the casing, the latter to be cut down as the mucilage wears off. A cap covers the projecting end, the gum stick being moistened when used.

CORNER BRACKET SHELF.—Joshua D. Legg, Long Eddy, N. Y. Combined with a triangular shelf having a frieze plate securable to its front edge is an adjustable pointed rod located at the angle of the shelf opposite the frieze plate, bent arms pivoted at opposite sides of the shelf having prongs on their outer limbs to project beyond the shelf, with turn buttons for locking the arms in position.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co., for 25 cents each. Please send name of the patentee, title of invention, and date of this paper.

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Notes & Queries

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Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

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Minerals sent for examination should be distinctly marked or labeled.

INDEX TO NOTES AND QUERIES.

(4540) H. C. P. says: 1. A current of electricity passes through the primary wire of an induction coil, is the strength increased by the secondary wire or not? A. The primary current is diminished by the current in the secondary wire. 2. About how many feet of No. 20 insulated magnet wire to the pound? A. About 324. 3. Do the armature and fields of a motor use the same amount of current respectively while running? A. The field magnet requires much less current than the armature.

(4541) C. N. asks (1) whether the Brush machine gives a direct current or alternating current at its terminals. A. The Brush machine delivers the direct current. 2. What is the E. M. F. and C. of this dynamo? I suppose it is a 16 light dynamo giving an E. M. F. of 850 volts and 10 amperes, but I am not sure. Diameter of ring about 20 inches. Number of coils in same, eight. A. We are unable to furnish a reply to this query from the data sent. Better write to the manufacturer of the machine. 3. What transformer would be best for reducing a current of 850 volts to a pressure of 110 volts, and how many amperes would the current have? A. Any form of transformer will answer, provided it is adapted to your current. 4. How many 16 candle power 110 volts lamp would the dynamo run? A. About seventy-five 50-volt lamps. 5. Would one transformer be best and cheapest at the dynamo, or three transformers? A. It is better to have three transformers in parallel. 6. Please explain the action of a transformer, if a dynamo propels a current of 10 amperes at 1,000 volts and the pressure be reduced to 100 volts by a step-down transformer. A. The transformer is simply an inverted induction coil, and the ratio of the primary and secondary currents to each other is as the ratio of number of convolutions of the primary and secondary wires.

(4542) H. W. writes: Last fall I bought myself a pair of long rubber boots for hunting. The blackberries and bushes have worn the rubber on top of foot so thin that the water will come through. Can you tell me of any preparation, or how to make it, to put over this rubber, and which will last as well as the rubber? A. They cannot be satisfactorily repaired. Thin gutta percha leaf might be applied in patches, and made to adhere by a hot iron, or the ordinary shoemaker's cement, might be applied so as to fill the tissue. But you cannot, we fear, get much satisfaction in mending them.

(4543) W. S. asks: 1. I would like a recipe for making red and blue litmus paper. A. Dissolve litmus in water, neutralize with nitric acid until it is barely red, filter if necessary, and by the addition of caustic soda in very dilute solution, and added drop by drop, just restore the blue color. Dip paper in this and dry for blue litmus paper. For red add to the solution dilute nitric acid drop by drop until it is just red and use for red paper. 2. Would an electric motor when run as a dynamo give the same number of volts that it took to run it as a motor? A. No. 3. Can a dry electric battery be charged and run as a storage battery, and is it cheaper than the usual lead battery? A. No.

(4544) E. H. P. asks (1) whether or not a saturated solution of common salt in water will absorb any of the constituents of furnace gas, and therefore whether or not it may be used in collecting such gas. A. No more than plain water. It is not available for collecting gases. 2. Will you also kindly give an accurate method of determining, from the products of combustion, how much air had been supplied to the furnace? A. If all the oxygen evolved in combination in the products of combustion came from the air, then one-ninth the weight of the water, and 32-44 the weight of the carbonic acid gas, and 16-28 the weight of the carbonic oxide gas, give the amount of oxygen, and by multiplying this weight by 100 and dividing by 23 the weight of air is given. The problem is complicated by the presence of oxygen in combination as water or carbonate in the materials introduced into the furnace, and by the retention of some oxygen in combination in the ash; all this has to be allowed for.

(4545) C. H., Jr., asks: 1. Size of objective, length and power of telescope used by Galileo. A. The sizes of the telescopes made by Galileo are not stated. Their magnifying power is stated at 30 for the largest. 2. What is the variation from standard of an aneroid barometer in a year, and how is same corrected? A. The aneroid varies about one-tenth of an inch, when properly corrected by comparison with a mercury barometer. It will keep its adjustment if carefully handled. It has a key screw in the back for adjustment.

(4546) R. T. P. says: I am contemplating laying a cement walk, would like to know the best proportion of cement to sand to make the best walk. There are parties here laying walks 6 of sand to 1 of cement for the first 3 inches; seems to me not cement enough. A. One of cement to 6 of sand may do for the under layer, but the surface should be finished with a layer of 1 of cement to 2 of sand.

(4547) N. B., Australia, asks: 1. If an engine is provided with a fly wheel just large enough to insure a uniform motion of the machinery in a mill, would power be gained or lost by using a larger wheel? A. There is no power gained by the weight of a fly wheel beyond that necessary for regulating the speed. Extra weight is a loss by increasing journal friction. 2. A pair of rolls are used for grinding wheat, one roll running much faster than the other. Will the fast roll suffer more from friction on its grinding surface than the slow one? A. Normally both should wear equally.

(4548) A. E. S. asks what substance it is that, put into water, will cause the dirt to settle to the bottom immediately? A. There is no agent that will do this. A very small amount of alum, a few grains to the gallon, especially if ammonia is added to barely alkaline reaction after it, will clarify water if allowed to stand. A little albumen may be dissolved in it and the water boiled. Gelatine precipitated by tannic acid will have a clearing effect. All these agents require time for settling or filtration.

(4549) G. W. R. asks: We desire to run an alarm from a factory to the fire engine house. The distance is half a mile. We desire to run the alarm by battery. 1. What sized wire will be necessary? A. Use No. 20 wire. 2. Will it be necessary to run two wires, or can the return be made by ground? A. A ground return will be the best. 3. How many cells of Leclanche battery will be necessary? A. Four or five cells. 4. Will it be better to use insulated wire? A. It will be much better unless the wire is carried by insulators like a telegraph line. In such case bare wire can be used.

(4550) W. C. V. asks: Are the gas and oil heating stoves that allow the products of combustion to escape in the room safe to use, from a hygienic point of view? They have them for sale here that are claimed to be sufficient to heat a room fifteen feet square. Would such a stove be likely to be injurious to the health? A. The products of combustion from gas and oil stoves, principally carbonic acid gas, with a small portion of carbonic oxide gas, are well known to be unhealthy and poisonous to animal life. The carbonic oxide is a deadly poison. These stoves are largely sold throughout the United States, with claims for convenience and economy. They can be trusted on these grounds where there is sufficient ventilation to carry off the gases of combustion, as for kitchen use;

but great caution should be used in heating small, close rooms as stated, with closed door and window, when occupied. Bed rooms that are damp may be warmed and then ventilated with safety before going to bed.

(4551) A. R. H. says: Please inform me if you can compress water in a boiler when testing a boiler by cold water. When the boiler is full and I put my gauge on, do I not compress the air that is in the water when I start force pump, instead of the water? When filling boiler I am letting air out of the steam dome, and after the same is full I attach my gauge. Do I not displace air when more water enters the boiler? A. Water is slightly compressible, but not enough for observation in testing a boiler, because the elasticity of the metal in the shell allows it (the shell) to stretch more than the compressibility of the water. The air that may accidentally lodge at the irregularities in the shell, as well as the air mixed with the water, all help to make the gauge show compression. The pipe leading to the gauge is also liable to be filled with air, which also contributes to the apparent elasticity of the contents of the boiler.

(4552) I. G. B. says: It is said that the sun is on the meridian of any place but four times a year at 12 o'clock. That is sun and clock agree only at those times, which are 15th of April, 15th of June, 1st of September, and 25th of December. The question is why those particular days? Whereabout is the earth in its orbit on those days? A. The variation of the sun from mean clock time is a gradually increasing and decreasing amount from its perihelion and aphelion points due to the elliptic form of the earth's orbit, which alone would make but two terms in the yearly variation of time. The effect of the obliquity of the ecliptic so changes this condition that the combined sums and differences make four times in a year at which solar and clock or mean time agree as stated in your query. The sun is in perihelion about the 25th of December, and in aphelion about the 15th of June. As the velocity of the earth in the perihelion half of its orbit is greater than that in the aphelion half, so the curves of time difference are greater in the first and last quarter of the year, as shown in your almanac.

(4553) C. & L. ask: What is the cause of the moon's appearing of a reddish hue sometimes at its rising? To what is ascribed the enlarged form of the moon at times of rising? A. The red appearance of the moon and sun at rising and setting is caused by the unequal absorption by the atmosphere of the colored rays, which are combined in white light, the colored rays having the shortest wave lengths being first absorbed. The violet, indigo, blue, green, when the fading yellow gives the sun and moon the orange hue and occasionally a strong red. It is the vastly increasing distance that the light travels in the atmosphere on the horizon that causes absorption. The sun looks red at noon time through considerable depth of water. The increased diameter is only apparent, an illusion of eye. The measured horizontal diameter is the same as at higher altitudes.

(4554) E. A. McG. asks: 1. What is the buoyant force or negative weight of one cubic foot of hydrogen gas, of coal gas, of a vacuum, in ounces or pounds, taking the density of the air at sea level as a basis? A. There is no such thing as negative weight. In air at the sea level hydrogen has a buoyancy of about 70 pounds to 1,000 feet, and coal gas one-half as much. 2. How much stronger would a vessel containing hydrogen have to be, to resist its expansive force at a height of 10,000 feet, than at sea level, and what is the ratio of expansive force developed as it ascends? A. At the height named hydrogen or any gas inclosed at the sea level would exert a pressure of about 5 pounds to the square inch. The exact ratio can only be expressed by a complicated formula. 3. Is aluminum manufactured in any considerable quantities? If so, where, and what is about its value in the United States per pound? A. Yes; in Pittsburg and in other places. It is worth in quantities about $1.50 per pound.

(4555) T. W. writes: I am desirous of learning what agent I must employ to etch or rather engrave on hard sheet rubber, in the manner that nitro-muriatic acid acts on zinc, i. e., I wish to cover the rubber sheet with a coating of wax, soap or like matter, then scratch the desired lines into the said coating and apply to the lines such a liquid as will eat into rubber in the exposed places. A. Aside from the sand-blast method we know of no way of etching vulcanite or hard India rubber. An impression can be produced by a die or engraving pressed upon it while heated to 212° Fah. If the surface is now smoothed off and exposed to heat, the lines of compression will swell or expand again, and thus give a relief plate. See SCIENTIFIC AMERICAN SUPPLEMENT, No. 252.

(4556) E. N. A. asks how to make Pharaoh's serpents. A. These are little cones of sulphocyanide of mercury which, when lighted, give forth a long, serpent-like, yellowish-brown body. Prepare nitrate of mercury by dissolving mercury dioxide in strong nitric acid as long as it is taken up. Prepare also sulphocyanide of ammonium by mixing 1 volume sulphide of carbon, 4 strong solution of ammonia, and 4 alcohol. This mixture is to be frequently shaken. In the course of about two hours, the bisulphide will have been dissolved, forming a deep red solution. Boil this until the red color disappears and the solution becomes of a light yellow color. This is to be evaporated at about 80° Fah. until it crystallizes. Add little by little the sulphocyanide to the mercury solution. The sulphocyanide of mercury will precipitate, the supernatant liquid may be poured off, and the mass made into cones of about ½ inch in height. The powder of the sulphocyanide is very irritating to the air passages, and the vapor from the burning cones should be avoided as much as possible. To ignite them set them on a plate or the like, and light them at the apex of the cone.—From the "Scientific American Cyclopedia of Receipts, Notes and Queries."

(4557) P. A. F.—For Silvering Brass.—The first essential is that the metal be chemically clean, which is best done by the use of dilute nitric acid, followed by a wash with clean water, and then with dilute aqua ammonia, drying in sawdust. If the metal be then rubbed with chloride of silver dissolved in ammonia and then washed and again dried in sawdust, the result will be fine. It should, however, be immediately lacquered in order to preserve the surface. The chloride of silver is preferable to the nitrate. No battery is used. Or for thin plating dissolve in 10 or 12 drops of water and add nitrate of silver, 2 parts, cyanide of potassium 6 parts. Rub on the object.—Desilvering.—The following is a liquid which will dissolve silver without attacking copper, brass, or German silver, so as to remove the silver from silvered objects, plated ware, etc. It is a mixture of 1 part of nitric acid with 6 parts sulphuric, heated in a water bath to 160° Fah., at which temperature it operates best.

(4558) J. L. C. and F. P. ask how to make oleate of soda referred to oleate of soda, referred to page 162 of the SCIENTIFIC AMERICAN. A. To make the pure acid, 2 ounces of pure soap (almond oil is the best, but Castile will answer) are dissolved in 20 ounces of boiling water. One ounce of sulphuric acid, previously diluted with 2 ounces water and allowed to cool, is added. The fatty acids rise to the surface in an oily layer. The water is siphoned off, and they are washed three times with boiling water. The mass is allowed to cool, and is removed from the surface of the water, where it floats. It is weighed, mixed with ½ its weight of litharge, and heated (212°-225° Fah.) until complete combination is effected. This may be known by the cessation of any evolution of bubbles from the mass. The resulting lead plaster is allowed to stand mixed with 10 to 15 times its weight of ether in a tightly corked bottle until completely disintegrated. Then it is filtered, and to the filtrate hydrochloric acid is added as long as any lead is precipitated. The ethereal solution is poured off, and the ether recovered by distillation, leaving pure oleic acid. Two fl. drm. of the acid is added to somewhat less than 1 pint of boiling water, and solution of caustic soda very carefully added, drop by drop, until complete solution of the acid is effected, very carefully avoiding an excess of soda, and after cooling, water is added to make it measure just 1 pint. A standard soap solution is thus obtained. To this add ½ its bulk of the best glycerine. Shake long and well, and the mixture is ready for use.—From the new "Scientific American Cyclopedia of Receipts, Notes and Queries."

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DESIGNS.

TRADE MARKS.

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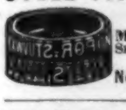

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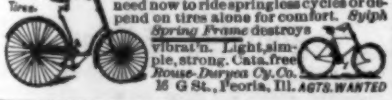

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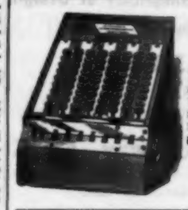

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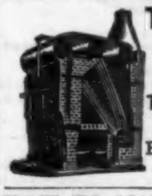

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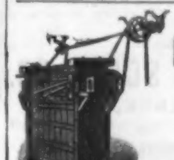

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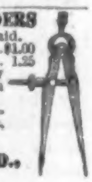

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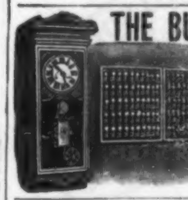

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